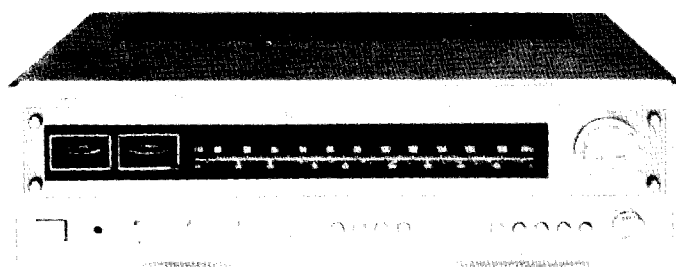


# ONKYO® SERVICE MANUAL

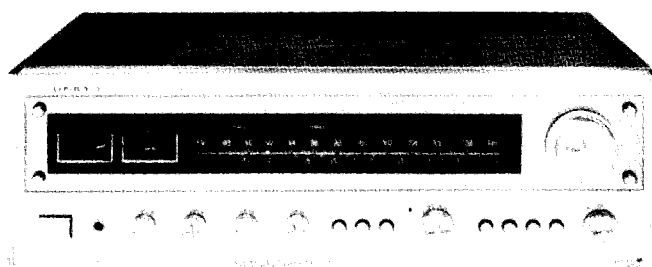
**QUARTZ LOCKED**

**STEREO RECEIVER  
TX-4500**



**SERVO LOCKED**

**STEREO RECEIVER  
TX-2500**



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**ONKYO®**  
**AUDIO COMPONENTS**

# SPECIFICATIONS

## MODEL TX-4500 QUARTZ LOCKED STEREO RECEIVER

|                           |  |   |   |
|---------------------------|--|---|---|
| Power Supply Rating       | AC 120 Volts 60 Hz   | Tilt (sag)  | better than 5% at 50 Hz.  |
| Controls                  | POWER<br>SPEAKERS (OFF, A, B, C, A + B, A + C)<br>SELECTOR (AM, FM AUTO, PHONO 1, PHONO 2)<br>TAPE MONITOR 1, 2, & 3<br>TUNING, VOLUME, BALANCE, TREBLE, BASS, DOLBY FM ADAPTOR, FM MUTING/LOCK, LOUDNESS, MODE, FILTER HIGH & LOW   | Sensitivity and Impedance   | PHONO-1/2: 2.5mV, 50 kohms<br>Tape Play -1/2/3: 150 mV 50 kohms.<br>TAPE REC -1/2/3: 150 mV 50 kohms<br>DOLBY OUT : 150mV 50 kohms<br>DOLBY IN : 580mV 50 kohms<br>PRE OUT : 1 V 3 kohms<br>MAIN IN : 1 V 100 kohms |
| Antennas                  | FM: 300Ω balanced, 75Ω unbalanced<br>AM: Built in ferrite core antenna and external terminal   | Phono Overload<br>Bass Control<br>Treble Control<br>Signal to Noise Ratio | 200 mV RMS 1 kHz 0.1%<br>±10 dB at 100 Hz<br>±10 dB at 10 kHz<br>PHONO: 65 dB<br>(IHF C NETWORK)<br>TAPE: 80 dB<br>(IHF C NETWORK)  |
| Outputs                   | SPEAKER A, B, & C,<br>HEADPHONES<br>TAPE REC OUT 1, 2, & 3,<br>FM DOLBY OUT, PRE OUT,<br>FM 4CH OUT  | Filters   | High: 6 kHz (6 dB/oct)<br>Low: 100 Hz (6 dB/oct)  |
| Inputs                    | PHONO 1 & 2, TAPE PLAY 1, 2 & 3, DOLBY IN, MAIN IN<br>FM AND AM ANTENNA  | <b>Tuner Section</b>  |   |
| Dimensions                | 21-3/16" W x 6-7/16" H x 16-15/16" D (max)<br>583 mm W x 163 mm H x 430 mm D   | Tuning Range  | FM: 88-108 MHz<br>AM: 530-1605 kHz  |
| Weight                    | 36.5 lbs. 16.6 kg  | Usable Sensitivity  | FM: Mono 1.8μV (10.3 dBf)<br>Stereo 5μV (19.2 dBf)  |
| Cabinet                   | Walnut grained vinyl over lauan plywood  | 50 dB Quieting Sensitivity  | FM: Mono 4μV (17.2 dBf)<br>Stereo 40μV (37.2 dBf)   |
| Semiconductors            | 1 FET, 70 transistors, 8 ICs, 59 diodes  | Intermediate Frequency  | FM: 10.7 MHz<br>AM: 455 kHz   |
| <b>Amplifier Section</b>  |  | Capture Ratio   | FM: 1.5 dB  |
| Power Output              | 65 watts per channel, min. RMS, at 4 ohms both channels driven from 20 Hz to 20 kHz, with no more than 0.1% total harmonic distortion.<br>55 watts per channel, min. RMS, at 8 ohms both channels driven, from 20 Hz to 20 kHz, with no more than 0.1% total harmonic distortion.<br>75 watts per channel, min. RMS, at 4 ohms both channels driven 1 kHz, 0.1% THD.<br>60 watts per channel, min. RMS, at 8 ohms, both channels driven, 1 kHz, 0.1% THD | Image Rejection Ratio   | FM: 70 dB<br>AM: 40 dB  |
| Total Harmonic Distortion | 0.1% at rated power<br>0.08% at 1 watts output   | IF Rejection Ratio  | FM: 100 dB<br>AM: 40 dB   |
| IM Distortion             | 0.3% at rated power<br>0.1% at 1 watts output  | Signal to Noise Ratio   | FM: 70 dB (mono)<br>65 dB (stereo)<br>AM: 40 dB   |
| Damping Factor            | 50 (8 ohms 1 kHz 10 watts)   | Alternate Channel att.  | FM: 70 dB   |
| Frequency Response        | 15-30,000 Hz (±1 dB)<br>2-80,000 Hz (±1 dB at main amplifier)  | AM Suppression Ratio  | FM: 50 dB   |
|                           |  | Harmonic Distortion   | FM: 0.2% (mono)<br>0.4% (stereo)<br>AM: 0.8%  |
|                           |  | Frequency Response  | FM: 30-15,000Hz +0.5, -2 dB   |
|                           |  | Stereo Separation   | FM: 40 dB at 1 kHz<br>30 dB at 100-10,000Hz   |
|                           |  | Muting Level  | FM: 4μV (17.2 dBf)  |
|                           |  | Stereo Lamp Level   | FM: 4μV (17.2 dBf)  |
|                           |  | Quartz Lock Level   | FM: 4μV (17.2 dBf)  |
|                           |  | Tuning Meters   | Signal Strength & Center Tuning   |

Specifications and features are subject to change without notice for improvement.

## SPECIFICATIONS

### MODEL TX-2500 SERVO LOCKED STEREO RECEIVER

#### Amplifier section

|                              |  |
|------------------------------|--|
| Power Output                 | 27 watts per channel,<br>min. RMS, at 8 ohms,<br>both channels driven,<br>from 40 Hz to 20 kHz,<br>with no more than 0.5%<br>total harmonic distortion.<br>34 watts per channel, min.<br>RMS, at 4 ohms, both<br>channels driven, from<br>40 Hz to 20 kHz, with no<br>more than 0.5% total<br>harmonic distortion.<br>(30 watts per channel, min. RMS,<br>at 8 ohms both channels driven,<br>1 kHz, 0.5% THD.)<br>(40 watts per channel, min. RMS,<br>at 4 ohms both channels driven,<br>1 kHz, 0.5% THD.) |
| Total Harmonic<br>Distortion | 0.5% at rated power<br>0.2% at 1 watt output   |
| IM Distortion                | 0.5% at rated power<br>0.3% at 1 watt output   |
| Damping Factor               | 40 (8 ohms 1 kHz 10 watts)   |
| Frequency Response           | 20 – 30,000 Hz ( $\pm 1$ dB)<br>2 – 60,000 Hz ( $\pm 1$ dB at power<br>amplifier)  |
| Tilt (sag)                   | better than 5% at 50 Hz.   |
| Sensitivity and<br>Impedance | PHONO: 2.5 mV 50 kohms<br>TAPE PLAY: 150 mV 50 kohms<br>TAPE REC: 150 mV 50 kohms<br>DOLBY OUT: 150 mV 50 kohms<br>DOLBY IN: 580 mV 50 kohms   |

|                       |   |
|-----------------------|---|
| Phono Overload        | 150 mV RMS 1 kHz 0.5% THD                                   |
| Bass Control          | $\pm 10$ dB at 100 Hz                                       |
| Treble Control        | $\pm 10$ dB at 10 kHz                                       |
| Signal-to-Noise Ratio | PHONO: 65 dB (IHF C NETWORK)<br>TAPE: 80 dB (IHF C NETWORK) |
| Filter                | 6 kHz   |

#### Tuner section

|                               |   |
|-------------------------------|---|
| Tuning Range                  | FM: 88 – 108 MHz<br>AM: 530 – 1605 kHz  |
| Usable Sensitivity            | FM mono: $2\mu\text{V}$ (11.2 dBf)<br>FM stereo: $5\mu\text{V}$ (19.2 dBf)<br>AM: $25\mu\text{V}$ |
| 50 dB Quieting<br>Sensitivity | FM mono: $4\mu\text{V}$ (17.2 dBf)<br>FM stereo: $40\mu\text{V}$ (37.2 dBf)                       |
| Intermediate<br>Frequency     | FM: 10.7 MHz<br>AM: 455 kHz   |
| Capture Ratio                 | FM: 2 dB  |
| Image Rejection               | FM: 45 dB AM: 40 dB   |
| IF Rejection                  | FM: 80 dB AM: 30 dB   |
| Signal-to-Noise Ratio         | FM mono: 65 dB<br>FM stereo: 60 dB<br>AM: 40 dB   |
| Alternate Channel att.        | FM: 60 dB   |
| AM Suppression                | FM: 50 dB   |
| Harmonic Distortion           | FM mono: 0.2% AM: 0.8%<br>FM stereo: 0.4%   |
| Frequency Response            | FM: 30 – 15,000 Hz $\pm 0.5$ , -2 dB  |
| Stereo Separation             | FM: 37 dB at 1 kHz<br>30 dB at 100 – 10,000 Hz  |
| Muting Level                  | FM: $4\mu\text{V}$ (17.2 dBf)   |
| Stereo Lamp Level             | FM: $4\mu\text{V}$ (17.2 dBf)   |
| Locking Level                 | FM: $4\mu\text{V}$ (17.2 dBf)   |
| Tuning Meter                  | Signal Strength & Center Tuning   |

Specifications and features are subject to change without notice.

## CIRCUIT DESCRIPTION

### 1. Tuning Knob

Touch of the tuning knob causes the ham to be initiated, which, in turn, is amplified at Q 126, followed by rectification at D 119, and 120, while the transistor of Q 135 allows passage thereby causing the signal for the local oscillation frequency regulation to drop to the earth, thus leading to a perfect tuning.

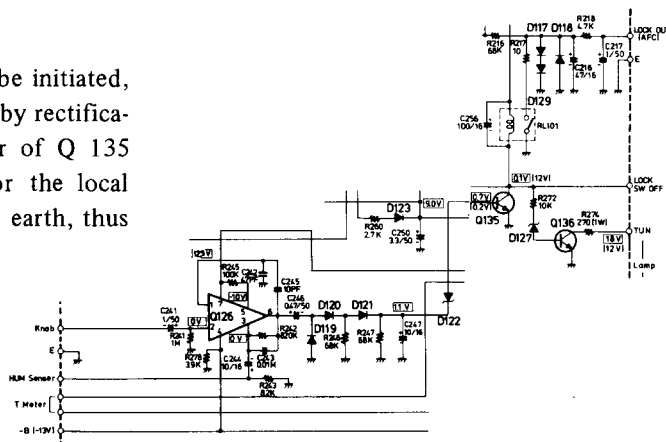


fig-1

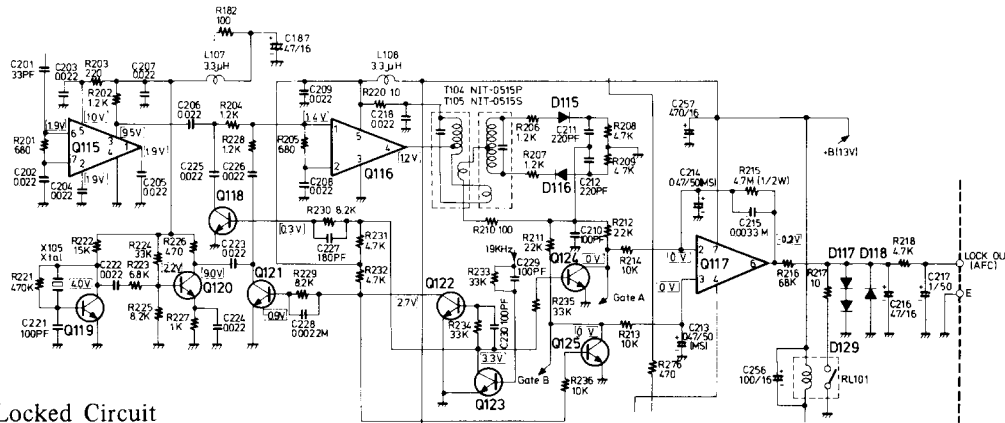


fig-2

## 2. Quartz Locked Circuit

The IF component of the quadrature detector output of Q 102 and the quartz oscillation signal at 10.7 MHz of Q 119 are detected with the cycle of 19 KHz, and the variance of the detected output is amplified with the DC voltage being imparted to the variable capacitance diode at the front end. In this way, the local oscillation frequency is regulated.

### (Circuit Performance)

Q 123 is set to ON-OFF motions with the rectangular waves at 19 KHz inducted from No. 10 terminal of Q 103 of MPX IC at the cycle of 19 KHz.

In case Q 123 is set to ON position, Q 118 and 124 are turned OFF, and the IF signal is amplified by Q 116, detected at T 104 and 105 and added to No. 2 terminal of Q 117.

Q 122, on the other hand, is turned OFF as Q 123 is set to ON position, with Q 121 and 125 being also turned ON to cause the quartz oscillation signal (10.7 MHz) to precipitate to the earth. Conversely, when the Q 123 is turned OFF, the switching transistors (Q 118, 121 – 125) perform functions in complete reversal to the above, with the quartz oscillation signal amplified by Q 116, detected in turn at T 104 and 105, added to No. 3 terminal of Q 117, resulting in the fall of the IF component to the earth.

The preceding performance repeats itself at 19 KHz, amplifying the input variance (between the IF signal and the quartz oscillation signal) with the OP amplifier of Q 117, which is then caused to pass the low-pass filter, to be imparted to the variable capacitance diode. In this manner, the local oscillation frequency is regulated.

The deviation from center of the detector transformers T 104 and T 105 will be registered alike with both transformers and will have no relationship whatsoever with the AFC input.

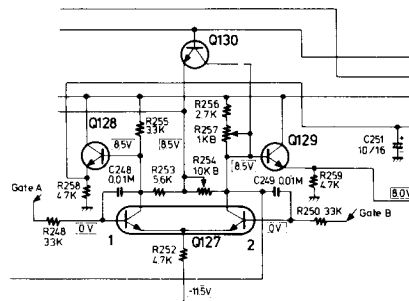


fig-3

## 3. Tuning Meter Circuit

The IF signal and the quartz signal detected at the 19 KHz cycle are added to the bases 1 and 2 of Q 127. Since the voltage at the bases 1 and 2 of Q 127 are equal to each other at the time of tuning, the voltage at the bases of Q 128 and 129 (OV) will also be equivalent to each other, thereby causing the T-meter to point to the center.

In the event the IF frequency is on a higher level than the quartz frequency, the T-meter is caused to swing to the left as the voltage at the base 1 of Q 127 is higher in this case than that at the base 2, and at the same time, same at the base of Q 128 is registered at a lower level than at the base of Q 129. Incidentally, R 257 and R 254 are the semi-fixed volume designed to regulate the T-meter center and the breadth of the same, respectively. In addition, Q 130 is designed to avert any error in performance by shortcircuiting the T-meter at the time of detuning.

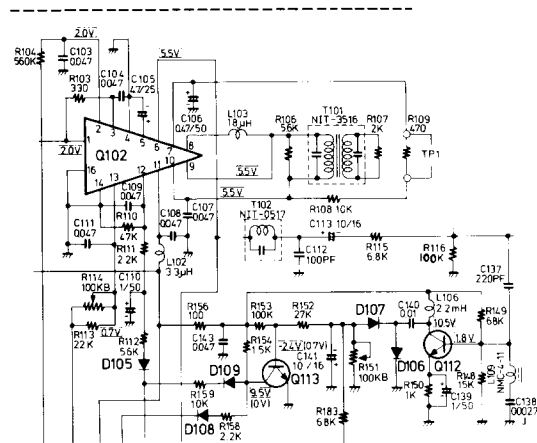
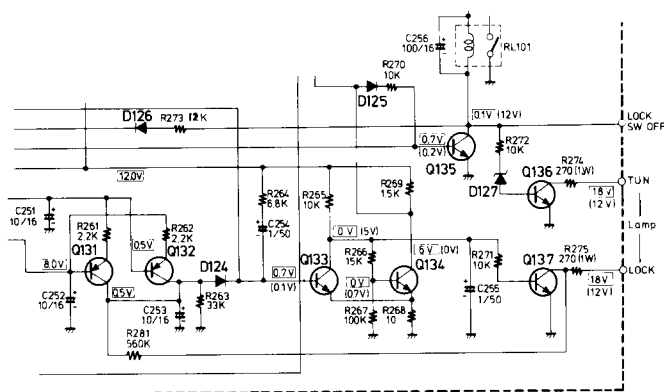


fig--4

#### 4. Muting Circuit

The muting circuit is operated through utilization of functions of the IF carrier, the 0-point detection (variance in detected waves between IF and Quartz) and the noise component.

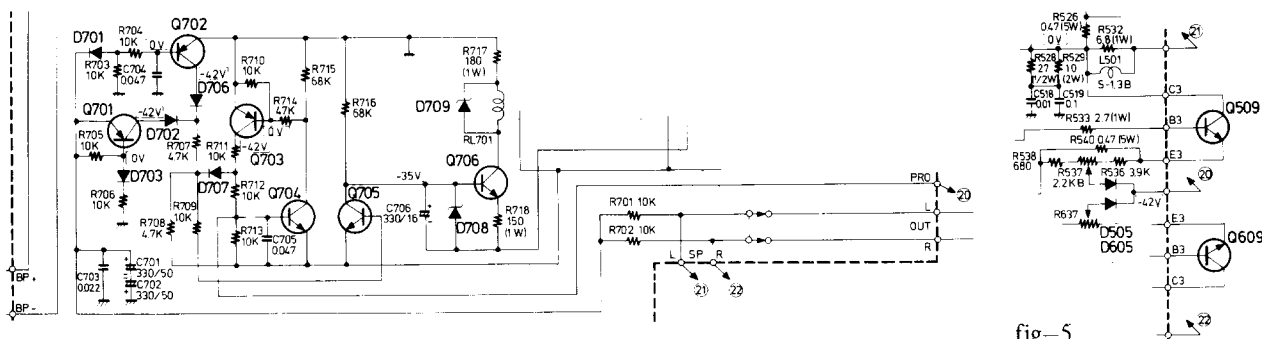
(At time of tuning)

For reasons that the base potential of Q 128 and 129 is in the state of 0V in terms of direct current as can be noted from the description given of the T-Meter Circuit at the time of tuning, the emitter potential of Q 128 and 129 is rendered equal to each other. As for Q 131 and 132, these are cut off to cause 0V output to be brought forth. At the same time, the IF carrier portion, at the time of tuning, is at a lower level in voltage than the standard level for the Schmitt trigger of Q 133 and 134 as muting regulating output inside the quadrature detector IC. For this reason, Q 133 is turned OFF while Q 137 is turned ON, which, in turn, causes Q 109 and 110 to be turned OFF.

(At time of detuning)

When the voltage of the 0-point (the variance in output between the IF detector and quartz detector) has turned positive or negative, if it come to stay on the plus side, for instance, the base potential of Q 128 is caused to drop, that of Q 129 to pick up, with Q 132 and 133 being turned ON. Again Q 109 and 102 are turned ON at the same time, with the signal being caused to drop to the earth. Again, simultaneously, Q 133 is turned ON, Q 134 OFF, Q 135 ON, causing the AFC circuit to be closed. In addition, the IF carrier portion, too, is caused to act upon Q 133, turning Q 133 ON.

Again, the L 106 resonance point is arranged at a higher level as the noise portion enters into the Q 112 base, so that Q 112 may act on the noise amplifier, causing the Q 113 to be turned OFF. This passes through D 109 and is added to the base of Q 131. It also passes through D 105, causing the transistor of Q 130 to be turned ON, and thus, causing, in turn, the meter circuit to be shortcircuited, thus ensuring against any error in performance.



## 5. The Explanation of Protection Circuit

### 1. Steady function

While the B voltage is supplied to the protection circuit as the power source switch is turned on, it is so designed as to allow a lag of almost 4 seconds in the time required for the relay to be turned ON, by means of the time-constant circuit set to motion by R 716 and 706 so that a drop in the output may be prevented of the main circuit in the unsteady state.

In the steady state, transistors of Q 701 to Q 705 are cut off, so much so that the voltage at both ends of C 706 is caused to register a value of 6 by the function of R 720 and D 709, causing the transistor of Q 706 and the delay to be turned ON, bringing forth the output.

Again, D 709 is designed so as to keep both ends of the relay coil from being brought under the pressure of abnormal voltage. In addition, IS 1554 between the base collectors for respective transistors is designed to thwart inverse current.

### 2. Detection of abnormal voltage

As the equivalent of 2 or more is generated at the center line of the main amplifier, there is a mixing between the right side and the left side at R 701 and 702, with the alternate current portion being cut off at C 701 and 702. In the case that the direct current generated here is negative, the current, passing through D 701, is broken up into partial pressure, acting on the base of the transistor at Q 702, which, in turn, causes Q 702 to open up allowing the current to pass through in the sequence of D 706 — R 707 — R 708.

As a result, the portion of voltage generated by R 708 is caused to be reinforced to Q 705, rendering the transistor to be turned ON. This, in turn, causes the voltage of the collector at Q 705 to fall, thus making the base potential of Q 706 go deeper into the negative side and turning the Q 706 OFF. This in turn causes the relay to be turned OFF, and also, the output circuit to be cut off.

In the event the base potential is on the positive side, the similar function takes place within the loop of Q 721 — D 702 — R 707 — R 708.

By eliminating a cause or causes for DC generation at the center line, the relay is caused to turn ON by the function staged in reverse order of the description given, causing the proper function to start automatically.

### 3. Detection of abnormal current

When the abnormal current is generated on the driver stage (power stage) of the main amplifier, the voltage is detected by the collector resistance and added subsequently to semi-solid resistance R 537 and 637 which are designed for current detection in the protection circuit. (The semi-solid resistance is set to function with the adequate flow of current causing the protection circuit to start operating. Refer to the Chapter dealing with Adjustment.) By the voltage reaching Q 704 by way of D 536 and D 636, Q 704 is caused to be turned ON while R 705 witnesses a voltage drop, resulting in Q 703 being turned ON.

As a result, the current flows in the sequence of Q 703 — R 711 — D 707 — R 708, and by the voltage generated at R 708, Q 705 is turned ON while Q 706 is turned OFF, causing the relay, in turn, to be turned OFF, thereby cutting off the output circuit. By the voltage added to the base of Q 704 through R 713, on the other hand, Q 704 is turned ON and on account of this, the lock circuit is set to work by Q 704 and Q 703, causing the relay to be kept in the OFF state.

In the event a large current flows into the transistor of the main circuit, the said circuit is caused to start functioning, locking up the amplifier output in the OFF state. For this reason, it is necessary for the power source to be cut off before setting out to remove the cause for abnormal current. Turning the power source back on will set off the normal function. It should be noted that turning the lock circuit on immediately after the power source was turned OFF will not lead to a spontaneous release of the lock-up, and therefore, it must be assured that the lock circuit is turned ON a few seconds after the power source has been turned OFF.

## - 7 -



## COMPONENT LOCATION

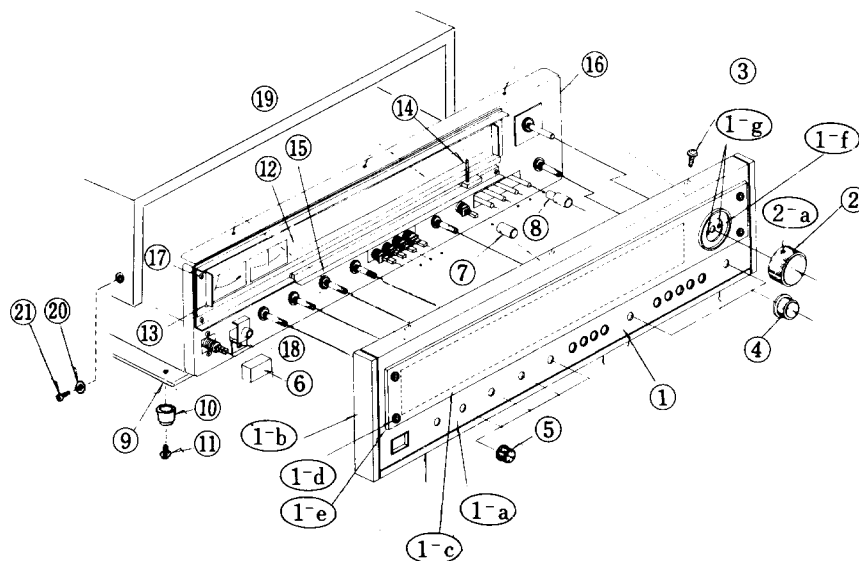
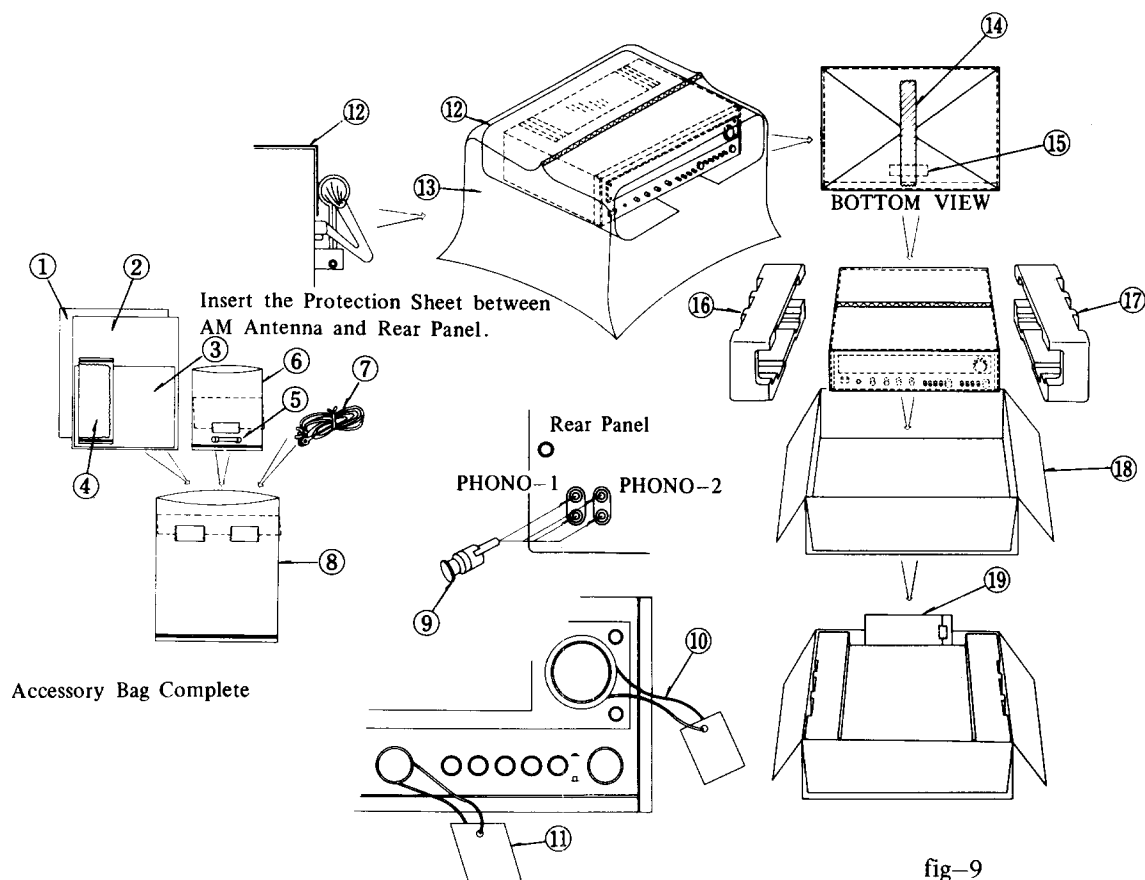


fig-8

| ITEM | DESCRIPTION             | TX-4500<br>STOCK NO. | Q'TY | TX-2500<br>STOCK NO. | Q'TY |
|------|-------------------------|----------------------|------|----------------------|------|
| 1    | Front Panel Ass'y       | 13829121             | 1    | 13809121             | 1    |
| 1-a  | Front Panel             | 27210045             | 1    | 27210046             | 1    |
| 1-b  | End Cap                 | 28125032             | 2    | 28125032             | 2    |
| 1-c  | Dial Glass              | 28191007             | 1    | 28191008             | 1    |
| 1-d  | Spacer                  | 27270014             | 4    | 27270014             | 4    |
| 1-e  | Decorative Screw        | 27300038             | 4    | 27300038             | 4    |
| 1-f  | Tuning Ring             | 27265003             | 1    | 27265003             | 1    |
| 1-g  | Tapping Screw 3STS+6BQ  | 834130062            | 2    | 834130062            | 2    |
| 2    | Tuning Knob             | 28320136             | 1    | 28320136             | 1    |
| 2-a  | Enamel Screw            |                      | (1)  |                      | (1)  |
| 3    | Tapping Screw           | 831130082            | 6    | 831130062            | 6    |
| 4    | Volume Knob             | 28320132             | 2    | 28320132             | 2    |
| 5    | Tone Knob               | 28320131             | 4    | 28320131             | 4    |
| 6    | Power Knob              | 28320130             | 1    | 28320130             | 1    |
| 7    | Push Button A           | 28320133             | 5    | 28320133             | 4    |
| 8    | Push Button B           | 28320134             | 4    | 28320134             | 3    |
| 9    | Bottom Board            | 27170013A            | 1    | 27170014A            | 1    |
| 10   | Rubber Cushion          | 280889               | 4    | 280889               | 4    |
| 11   | Tapping Screw 3STS+16BQ | 831130162            | 4    | 831130162            | 4    |
| 12   | Dial Plate              | 28130032A            | 1    | 28130034             | 1    |
| 13   | Bracket-Dial Plate      | 27240006             | 1    | 27240007             | 1    |
| 14   | Pointer Ass'y           | 13829133             | 1    | 13829133             | 1    |
| 15   | Pointer Rail            | 27300035             | 1    | 27300036             | 1    |
| 16   | Bracket-Front           | 27110023B            | 1    | 27110024B            | 1    |
| 17   | Tapping Screw 3STS+10BQ | 834180102            | 4    | 834130102            | 4    |
| 18   | Bracket-Headphone       | 27140090A            | 1    | 27140090             | 1    |
| 19   | Amp. Box                | 28110057A            | 1    | 28110058B            | 1    |
| 20   | Washer 4-12BS-Ni        | 870040               | 4    | 870040               | 4    |
| 21   | Screw 4MS+15BS-Ni       | 82374015             | 4    | 82374015             | 4    |



# PACKING PROCEDURE



| ITEM | DESCRIPTION                       | TX-4500<br>STOCK NO. | Q'TY | TX-2500<br>STOCK NO. | Q'TY |
|------|-----------------------------------|----------------------|------|----------------------|------|
| 1    | Instruction Manual                | 29340125             | 1    | 29340127             | 1    |
| 2    | Caution Card-W                    | 29355036-1           | 1    | 29355036-1           | 1    |
| 3    | Warranty Card                     | 293036-1             | 1    | 293036-1             | 1    |
| 4    | Silicon Cloth                     | 292017-2             | 1    | 292017-2             | 1    |
| 5    | Fuse 3A(ST-2)                     | NONE                 |      | 252005               | 1    |
|      | 3A(SS-2)                          | NONE                 |      | 252006               | 1    |
|      | 4A(ST-2)                          | 252038               | 1    | NONE                 |      |
| 6    | Poly Bag 80X150                   | 29100002             | 1    | 29100002             | 1    |
| 7    | FM Antenna Ass'y                  | 292064               | 1    | 292064               | 1    |
| 8    | Poly Bag 350X250                  | 29100006A            | 1    | 29100006A            | 1    |
| 9    | Shorted Pin PO-107                | 250153               | 4    | 250153               | 2    |
| 10   | Tag-Sensor                        | 29355039             | 1    | 29355039             | 1    |
| 11   | Tag-Cabinet Composition           | 29380004             | 1    | 29380004             | 1    |
| 12   | Sheet 500X1200                    | 290093               | 1    | 290093               | 1    |
| 13   | Poly Bag 720X1020                 | 29100020             | 1    | 29100020             | 1    |
| 14   | Adhesive Tape W30                 | 261504               | 40cm | 261504               | 40cm |
| 15   | Caution Card                      | 293041               | 1    | 293041               | 1    |
| 16   | Pad-Side (Left)                   | 29090116A            | 1    | 29090116A            | 1    |
| 17   | Pad-Side (Right)                  | 29090115A            | 1    | 29090115A            | 1    |
| 18   | Master Carton Box                 | 29050054             | 1    | 29050060             | 1    |
| 19   | Accessory Bag Complete (1-2, 4-8) | 13829119             | 1    |                      | 1    |

# ALIGNMENT PROCEDURE

## INSTRUMENTS REQUIRED

1. DC Ammeter
2. DC Voltmeter
3. AM/FM Sweep Generator
4. AM/FM Signal Generator
5. Vacuum Tube Voltage Meter (VTVM) AC, DC
6. Oscilloscope
7. Monitorscope
8. Distortion Analyzer
9. Stereo Modulator
10. Frequency Counter
11. CR Oscillator

## GENERAL ALIGNMENT CONDITIONS

1. Signal input should be kept as low as possible.
2. Standard modulation is 400Hz 30% (AM), 400Hz 100% (FM MONO), pilot 10% sub and main 90% (FM STEREO).
3. Standard knob position  
 SPEAKERS..... A      VOLUME..... Maximum  
 BASS, TREBLE & BALANCE..... Center  
 LOW & HIGH FILTER..... OFF  
 MODE..... STEREO  
 LOUDNESS..... OFF  
 MUTING LOCK & DOLBY ADAPTOR..... OFF  
 TAPE 1, 2, 3..... OFF (SOURCE)

## CENTER VOLTAGE ADJUSTMENT

Connect a 8-ohm load resistor across the SPEAKER terminals.  
 Connect the DC Voltmeter between CT and E terminal.

TX-4500

Adjust the voltage to  $0 \pm 20\text{mV}$  with R504. (Left channel)  
 Adjust the voltage to  $0 \pm 20\text{mV}$  with R604. (Right channel)

TX-2500

Adjust the voltage to  $0 \pm 40\text{mV}$  with R504. (Left channel)  
 Adjust the voltage to  $0 \pm 40\text{mV}$  with R604. (Right channel)

NOTE: Adjust after switching on for 10 minutes.

## IDLING CURRENT ADJUSTMENT

Connect the DC Voltmeter between ID and CT terminal.

TX-4500

Adjust the voltage to  $20 \pm 5\text{mV}$  with R518. (Left channel)  
 Adjust the voltage to  $20 \pm 5\text{mV}$  with R618. (Right channel)

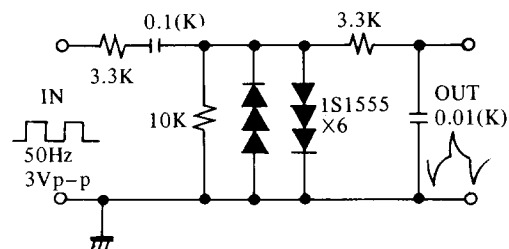
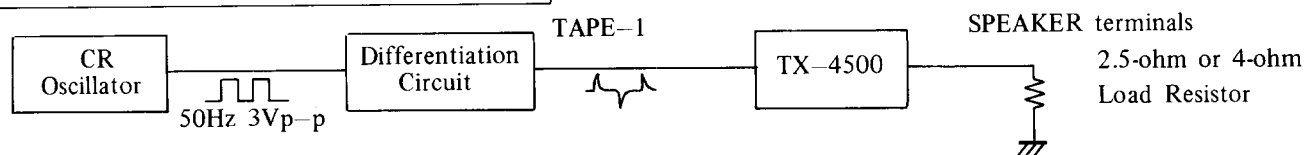
TX-2500

Adjust the voltage to  $20 \pm 5\text{mV}$  with R514. (Left channel)  
 Adjust the voltage to  $20 \pm 5\text{mV}$  with R614. (Right channel)

NOTE: Adjust after switching on for 10 minutes.

Open load      VOLUME..... Minimum      TAPE MONITOR-1..... ON

## PROTECTIVE CIRCUIT ADJUSTMENT



| Load Resistor | CR Oscillator | Relay | Adjust                  |
|---------------|---------------|-------|-------------------------|
| 4-ohm, 100W   | 50Hz<br>3Vp-p | ON    | R537<br>(Left channel)  |
| 2.5-ohm, 100W |               | OFF   | R637<br>(Right channel) |

NOTE: VOLUME.....Maximum  
 TAPE MONITOR-1.....ON

fig-10 Differentiation Circuit

### ATTACHMENT OF DIAL POINTER

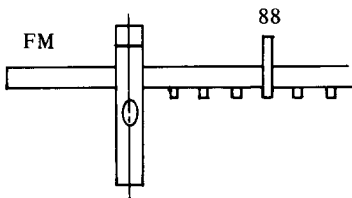
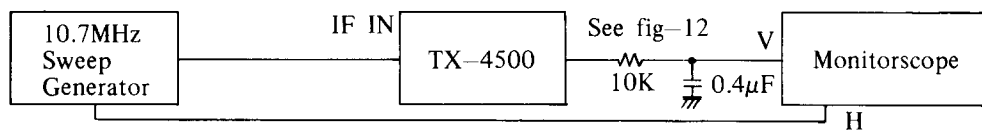


fig-11

1. Close the variable capacitor completely.
2. Set the radio dial pointer to zero (0) on dial scale and install the dial pointer ass'y.

## QUARTZ LOCKED CIRCUIT ALIGNMENT

Set **SELECTOR** switch to FM.



| 10.7MHz Sweep | Adjustment | Adjustment for                         |
|---------------|------------|--|
| 10.7MHz       | T104, 105  | Maximum symmetrical response<br>fig-13 |

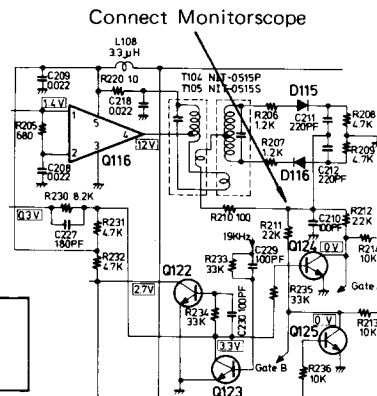


fig-12

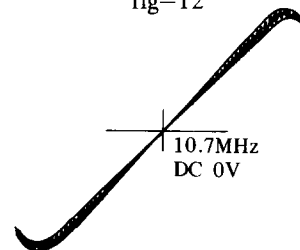
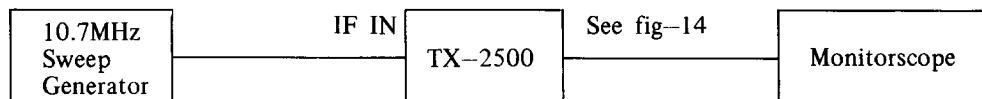


fig-13

## SERVO LOCKED CIRCUIT ALIGNMENT



|               |            |  |
|---------------|------------|--|
| 10.7MHz Sweep | Adjust     | Adjustment for                         |
| 10.7MHz       | T102, T104 | Maximum symmetrical response<br>fig-13 |

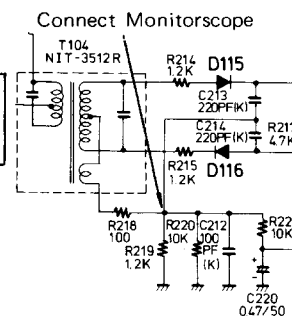
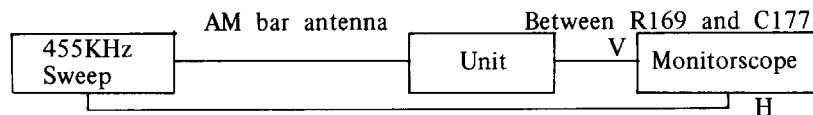


fig-14

### AM IF ALIGNMENT



| Set Radio Dial | Adjust                                 | Adjust for                     | Remarks                            |
|----------------|--|--------------------------------|------------------------------------|
| Upper end      | X104<br>(TX-4500)<br>X103<br>(TX-2500) | Maximum symetrical<br>response | Usually not necessary<br>to adjust |

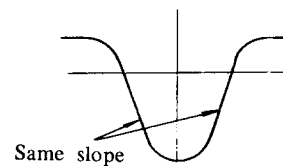
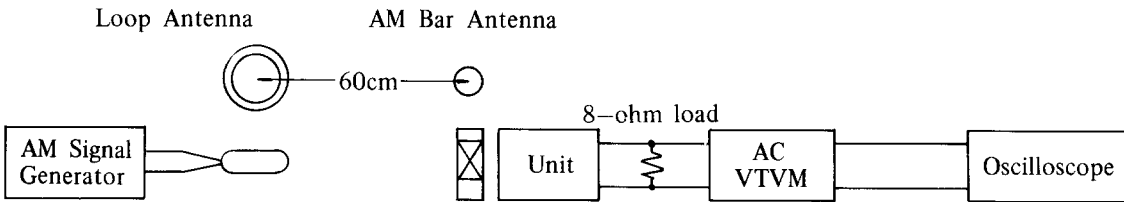


fig-15

## AM RF ALIGNMENT

Confirm start point of dial pointer before alignment.



Connect AC VTVM across LEFT SPEAKER terminals.

| Step | AM Signal Generator          | Dial to set          | Adjust           |                  | AC VTVM reading | Remarks                            |
|------|------------------------------|----------------------|------------------|------------------|-----------------|------------------------------------|
|      |                              |                      | TX-4500          | TX-2500          |                 |                                    |
| 1    | 515KHz<br>400Hz<br>30% mod.  | 515KHz<br>Lower end  | L105<br>NMO-2504 | L105<br>NMO-2503 | Maximum         | (Repeat step 1 and 2 as necessary) |
| 2    | 1680KHz<br>400Hz<br>30% mod. | 1680KHz<br>Upper end | TC-5             | TC-4             | Maximum         |                                    |
| 3    | 600KHz<br>400Hz<br>30% mod.  | 600KHz               | L001<br>NMA-2521 | L001<br>NMA-2520 | Maximum         | (Repeat step 3 and 4 as necessary) |
| 4    | 1400KHz<br>400Hz<br>30% mod. | 1400KHz              | TC-2             | TC-2             | Maximum         |                                    |

## FM FRONT END ALIGNMENT

Set SELECTOR switch to FM.

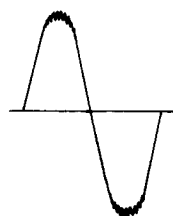
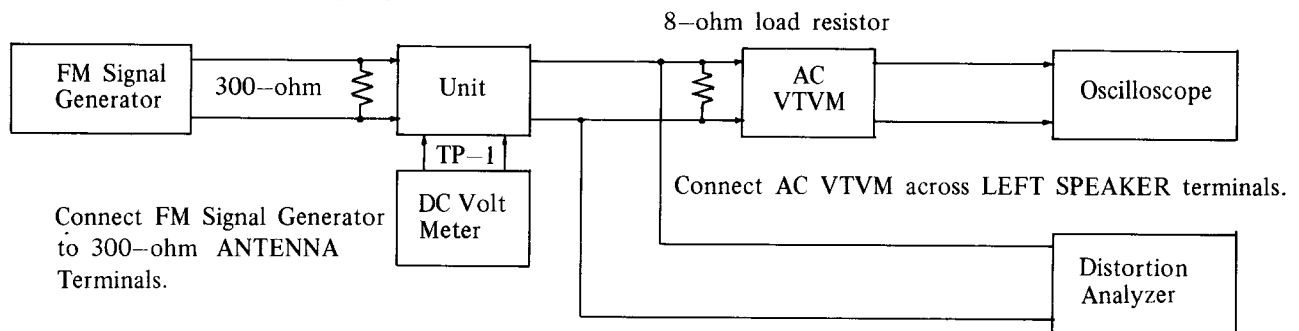
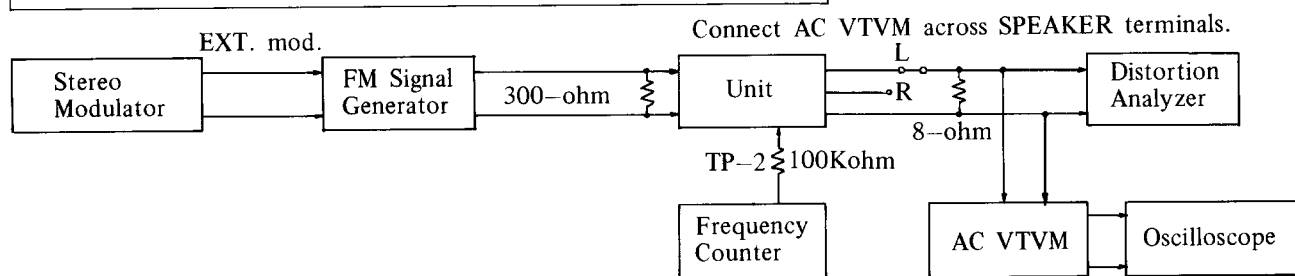


fig-16

| Step | FM Signal Generator               | Dial to set | Adjust                             |                 | Output Indicator        | Adjust for         | Remarks   |  |
|------|-----------------------------------|-------------|------------------------------------|-----------------|-------------------------|--------------------|---|--|
|      |                                   |             | TX-4500                            | TX-2500         |                         |                    |   |  |
| 1    | No Signal                         | Quiet Point | T101 Bottom                        | T101 Bottom     | DC Volt Meter           | 0mV                |   |  |
| 2    | 98MHz 400Hz<br>100% mod. 60dB     | 98MHz       | T101 Top                           | T101 Top        | Distortion Analyzer     | Minimum Distortion | Set the output voltage to 3V with VOLUME.                   |  |
| 3    | Repeat step 1 and 2 as necessary. |             |                                    |                 |                         |                    |   |  |
| 4    | 98MHz 400Hz<br>100% mod. 60dB     | 98MHz       | R257                               |                 | TUNING Meter            | Center             |   |  |
| 5    | 90MHz 400Hz<br>100% mod. 60dB     | 90MHz       | OSC Coil L0                        | OSC Coil L5     | DC Volt Meter           | 0mV                |   |  |
| 6    | 106MHz 400Hz<br>100% mod. 60dB    | 106MHz      | OSC Trimmer TC5(TC 0)              | OSC Trimmer TC5 | Same as above           | 0mV                |   |  |
| 7    | Repeat step 5 and 6 as necessary. |             |                                    |                 |                         |                    |   |  |
| 8    | 90MHz 400Hz<br>100% mod.          | 90MHz       | L1(LA)<br>L2(LR1)<br>L3(LR2)       | L1<br>L2        | AC VTVM or Oscilloscope | Maximum            | Set FM Signal Generator level as low as possible.<br>fig-16 |  |
| 9    | 106MHz 400Hz<br>100% mod.         | 106MHz      | TC1(TCA)<br>TC3(TCR1)<br>TC4(TCR2) | TC1<br>TC3      | Same as above           | Maximum            |   |  |
| 10   | Repeat step 8 and 9 as necessary  |             |                                    |                 |                         |                    |   |  |
| 11   | 98 MHz 400Hz<br>100% mod.         | 98MHz       | IF Core Top and Bottom L5          | IF Core L4      | AC VTVM or Oscilloscope | Maximum            |   |  |

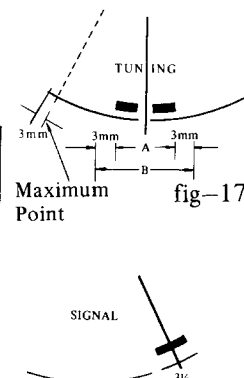
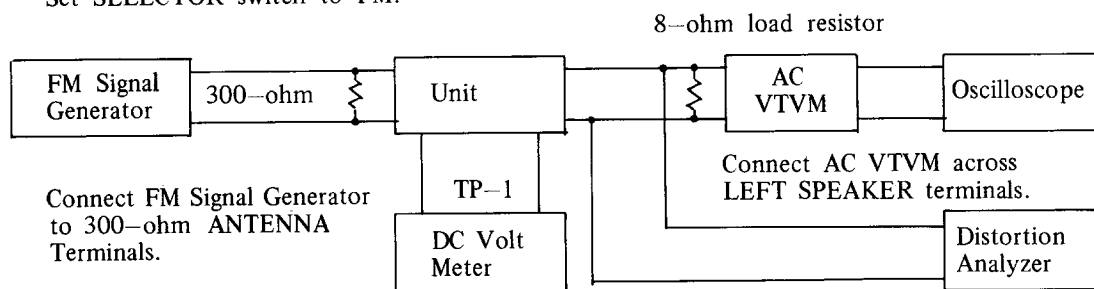
### FM MONO DISTORTION AND MULTIPLEX ALIGNMENT



| Alignment       | Step | FM Signal Generator   | Stereo Modulator                               | Dial to set | Adjust      |             | Output Indicator    | Adjust for | Remarks                        |
|-----------------|------|---|--|-------------|-------------|-------------|---------------------|------------|--------------------------------|
|                 |      |   |  |             | TX-4500     | TX-2500     |                     |            |                                |
| Mono Distortion |      | 98MHz 400Hz 100% mod. 60dB  | _____  | 98MHz       | T101 Bottom | T101 Bottom | Distortion Analyzer | Minimum    |                                |
| 19KHz           | 1    | 98MHz 400Hz 100% mod. 60dB  | _____  | 98MHz       | R142        | R127        | Frequency Counter   | 19000±19Hz |                                |
|                 | 2    | STEREO INDICATOR should light up when stereo program is being received. |  |             |             |             |                     |            |                                |
| Multiplex       | 1    | 98MHz EXT. Mod.   | Pilot Sig. 10%<br>Main & Sub Sig. 1KHz Lch 90% | 98MHz       | R138        | R157        | AC VTVM Right ch.   | Minimum    | Repeat step 1 & 2 as necessary |
|                 | 2    | Same as above   | Pilot Sig. 10%<br>Main & Sub Sig. 1KHz Rch 90% | 98MHz       | R138        | R157        | AC VTVM Left ch.    | Minimum    |                                |

### FM TUNING METER, STRENGTH METER AND MUTING ADJUSTMENT

Set SELECTOR switch to FM.



Set TUNING dial pointer and FM Signal Generator Frequency (no mod.) to 98MHz.  
Confirm LOCKED LAMP should light up.

fig-18

| Adjustment     |   | FM Signal Generator              | Dial to set | Adjust                           | Output Indicator              | Adjust for             | Remarks                  |
|----------------|---|----------------------------------|-------------|----------------------------------|-------------------------------|------------------------|--------------------------|
| TUNING METER   |   | 98MHz 60dB<br>no mod.            |             | R254(width)<br>R257(center)      | TUNING METER                  | fig-17                 | TX-4500                  |
| STRENGTH METER |   | 98MHz<br>400Hz 100%<br>mod. 70dB | 98MHz       | R114 (TX-4500)<br>R118 (TX-2500) | STRENGTH METER                | fig-18                 |                          |
| MUTING         | 1 | 98MHz<br>400Hz 100%<br>mod. 12dB | 98MHz       | R151 (TX-4500)                   | Oscilloscope<br>or AC<br>VTVM | signal                 | Repeat<br>step<br>1 & 2. |
|                | 2 | 11dB                             |             | R154 (TX-2500)                   |                               | no signal<br>and noise |                          |

## CHASSIS LAYOUT

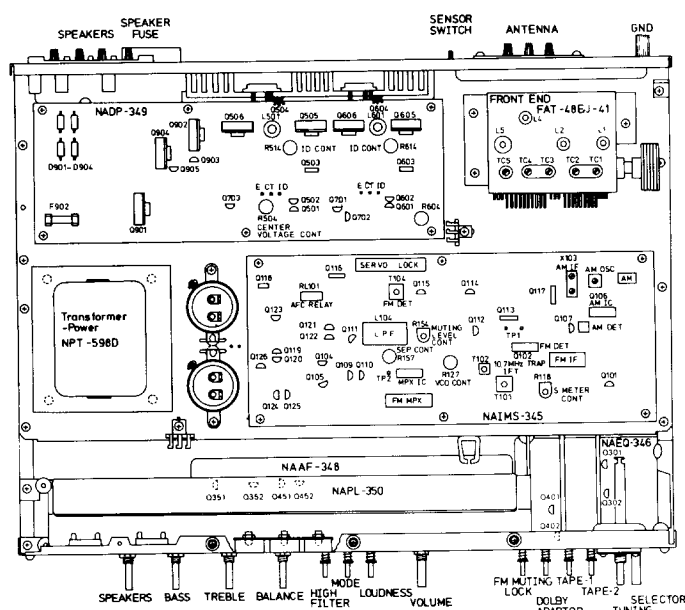


fig-19  
TX-2500  
TOP VIEW

## CHASSIS LAYOUT

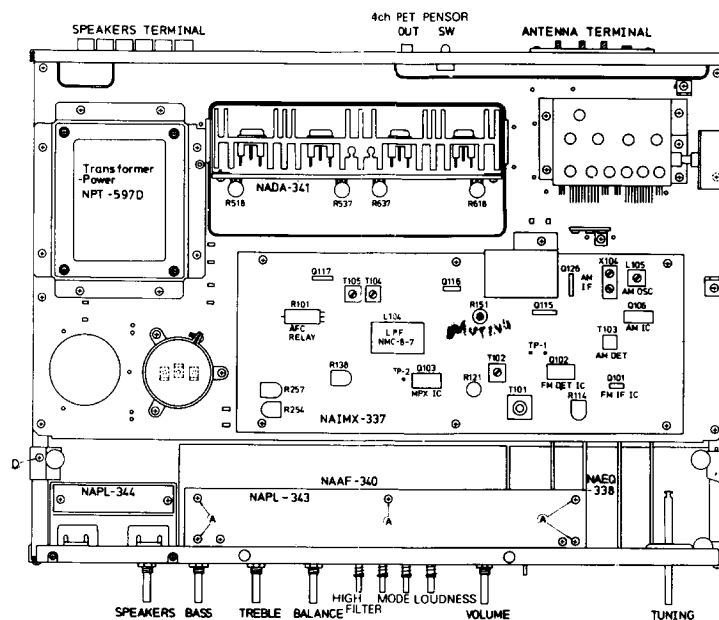


fig-20  
TX-4500  
TOP VIEW

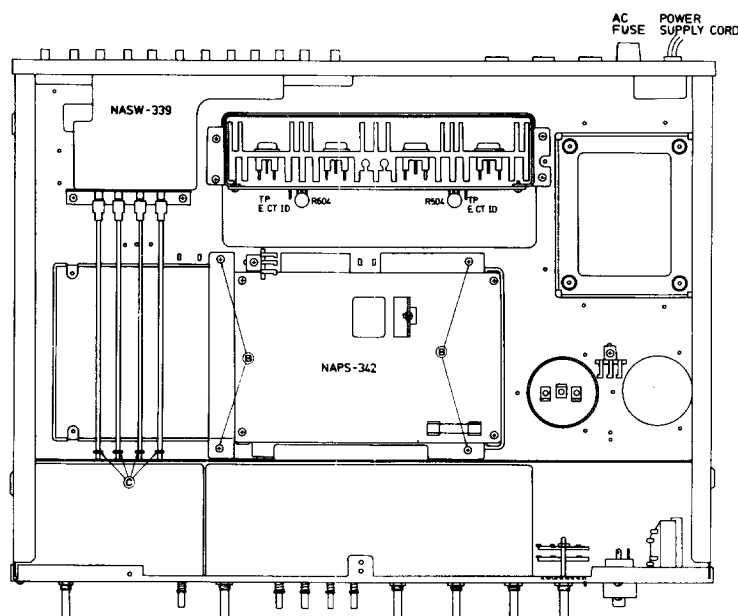


fig-21  
TX-4500  
BOTTOM VIEW

- Replacing of the pilot lamp requires release of 5 tapping screws on (A).
- Checking of the PC board of NAIMX-337 calls for removal of 4 tapping screws of (B).
- When replacing the push SW(TAPE MONI (AUX) 1 – 3, DOLBY), arrange for release of (C) E ring first.
- Adjustment in tension of the dial cord requires easing of tapping screw (D) to allow for sliding in position of metal fittings.

# TX-4500 PARTS LIST

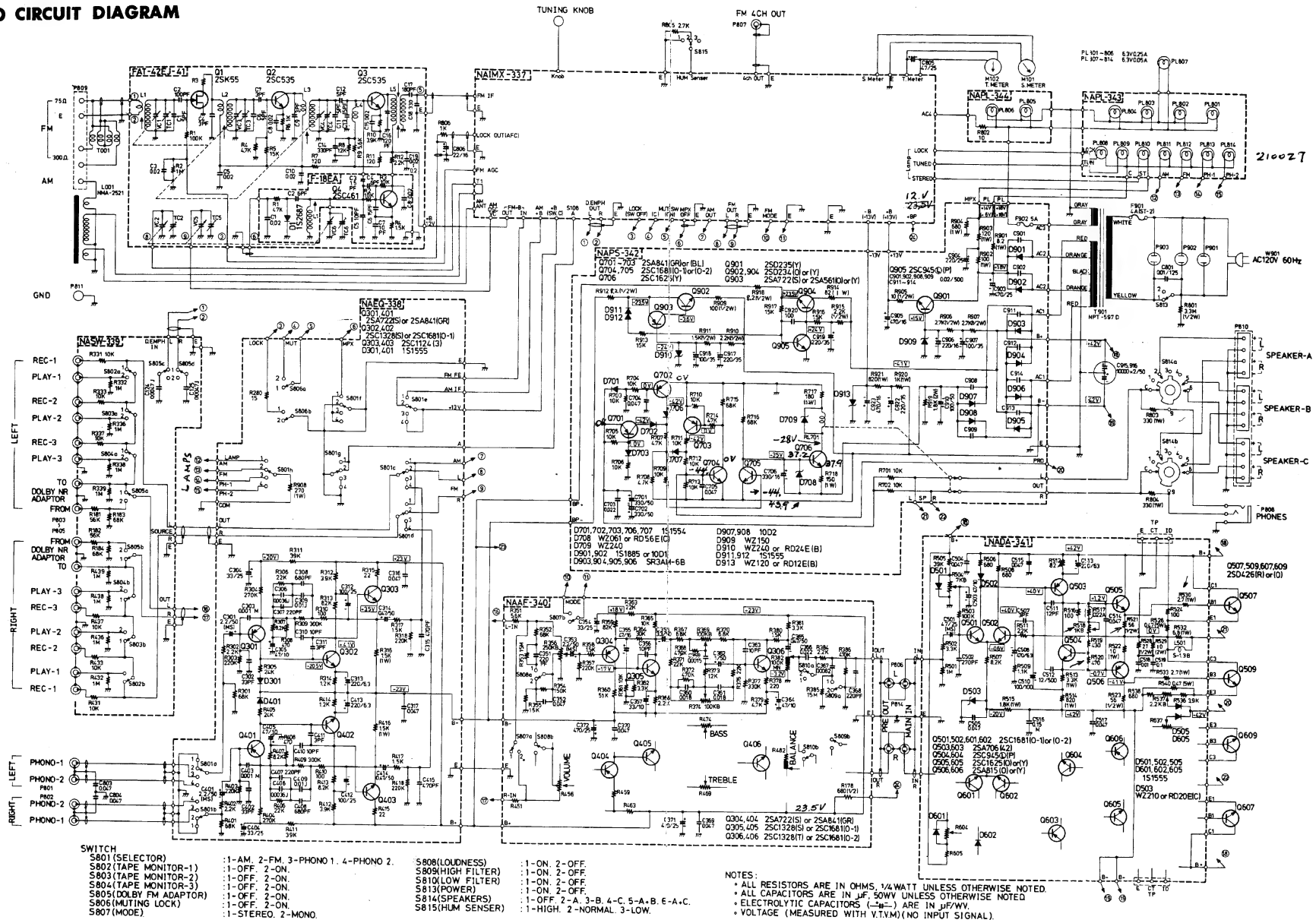
| PARTS NO.  | DESCRIPTION                | SPECIFICATIONS    | Q'TY | STOCK NO. | REMARKS                     |
|------------|----------------------------|-------------------|------|-----------|-----------------------------|
| U1         | Front End                  | FAT-42EJ-41       | 1    | 240035    |                             |
| U2         | Printed Circuit Board As'y | NAIMX-337         | 1    | 13829537  | Tuner Section               |
| U3         | Printed Circuit Board As'y | NAEQ-338          | 1    | 13829538  | Equalizer Section           |
| U4         | Printed Circuit Board As'y | NAW-339           | 1    | 13829539  | Switch Section              |
| U5         | Printed Circuit Board As'y | NAAF-340          | 1    | 13829540  | Tone Section                |
| U6         | Printed Circuit Board As'y | NADA-341          | 1    | 13829541  | Driver Section              |
| U7         | Printed Circuit Board As'y | NAPS-342          | 1    | 13829542  | Power Supply Section        |
| U8         | Printed Circuit Board As'y | NAPL-343          | 1    | 13829543  | Pilot Lamp Section          |
| U9         | Printed Circuit Board As'y | NAPL-344          | 1    | 13829544  | Pilot Lamp Section          |
| PL807      | Lamp-Pilot                 | 2SD426(R) or (O)  | 4    | 210015    | Using same h/c rank Pointer |
| T901       | Transformer-Power          | NPT-597D          | 1    | 230154    |                             |
| T001       | Transformer-BLN            | NBLN-1            | 1    | 230206    |                             |
| L001       | Coil-Antenna               | NMA-2521          | 1    | 232055    |                             |
| C801       | Capacitor-UL               | UL125V103M        | 1    | 350403    |                             |
| C805       | Capacitor-Elect.           | CE04W25V47µF      | 1    | 35274701  |                             |
| C806       | Capacitor-Elect.           | CE04W16V2µF       | 1    | 352742201 |                             |
| C915       | Capacitor-Elect.           | CE62B50V1000X25-L | 1    | 210015    |                             |
| R803, R804 | Resistor-Metal Oxide Film  | RS1WB330ohm       | 2    | 441623314 |                             |
| S812       | Switch-Push                | NPS111LLN4        | 1    | 25035027  | Power Source                |
| S814       | Switch-Rotary              | NRS-226-30Y       | 1    | 25030058  | Speakers                    |
| S815       | Switch-Slide               | NSS-2327          | 1    | 25065016  |                             |
| P801, P802 | Pin Jack                   | NTM-2WPBL-E1      | 2    | 250170    | PHONO                       |
| P806       | Pin Jack                   | NTM-4WPBL-E1      | 1    | 250169    | PRE, MAIN                   |
| P807       | Pin Jack                   | NTM-1WPBL-E1      | 1    | 250256    | 4 Channel Out               |
| P808       | Jack-Stereo Head Phone     | LJ-100-H          | 1    | 25045018  |                             |
| P809       | Terminal                   | NTM-3PUM1         | 1    | 25060021A | Antenna                     |
| P810       | Terminal                   | NTM-12PUM1        | 1    | 25060005  | Speakers                    |
| P811       | Terminal                   |                   | 1    | 270665    |                             |
| P814       | Shorted Plug               |                   | 2    | 25055015  |                             |
| P901-P903  | Socket-AC                  | S-16432           | 1    | 25050008  |                             |
| W901       | Power Supply Cord          | AS-UC             | 1    | 253072    |                             |
| F901       | Fuse                       | 4A (ST-2)         | 1    | 252038    |                             |
| F901a      | Fuse Holder                | S-N1301           | 1    | 250080    |                             |
| M101       | Tuning Indicator           | NIND-0500S53      | 1    | 243054    | Strength                    |
| M102       | Tuning Indicator           | NIND-0250S54      | 1    | 243055    | Tuning                      |
| S812, S815 | Socket-Transistor          | M-1614            | 4    | 250249    | Power Transistor            |
|            |                            | SKB-1             | 20   | 260208    |                             |
| A003       | Shorted Pin                | PO-107            | 1    | 250153    |                             |
| A001       | Chassis                    |                   | 1    | 27100013B |                             |
| A006       | Drum                       |                   | 1    | 27200020  |                             |
| A007       | Spring                     | SP-14A            | 2    | 273803    |                             |
| A008       | Dial String                |                   | 1    | 273903    |                             |
| A009       | Heat Sink                  |                   | 1    | 27160015  |                             |
| A013       | Shaft                      |                   | 4    | 27260005  | Push Switch                 |
| A015       | Joint                      |                   | 4    | 28320135  | Push Switch                 |
| A017       | Shielded Plate             |                   | 1    | 27150045  |                             |
| A034       | Dial Pulley                | DP-16N            | 4    | 271850002 |                             |
| A041       | Drive Shaft As'y           |                   | 1    | 27205005  |                             |
| A042       | Shielded Plate             |                   | 1    | 281750004 |                             |
| A045       | Pointer                    |                   | 1    | 28165031  |                             |
| A047       | Pointer Slider             |                   | 1    | 27220008  |                             |
| A049       | Dial Plate                 |                   | 1    | 28130032A |                             |
| A069       | Back Panel                 |                   | 1    | 27120038  |                             |
| A071       | Holder-Antenna             |                   | 1    | 27190015A |                             |
| A072       | Strain Relief              | SR-3P-4           | 1    | 270025    |                             |
| A073       | Strain Relief              | SR-4K-4           | 1    | 270280    |                             |
| A301       | Amp Box                    |                   | 1    | 28110057A |                             |
| A305       | Front Panel As'y           |                   | 1    | 13829121  |                             |
| A501       | Front Panel                |                   | (1)  | 27210045  |                             |
| A502       | End Cap                    |                   | (2)  | 28125032  |                             |
| A503       | Clear Plate                |                   | (1)  | 28191007  |                             |
| A504       | Spacer                     |                   | (4)  | 27270014  |                             |
| A505       | Decorative Screw           |                   | (4)  | 27300038  |                             |
| A509       | Tuning Ring                |                   | (1)  | 27265003  |                             |
| A802       | Knob-Tuning                |                   | 1    | 28320136  |                             |
| A803       | Knob-Volume                |                   | 2    | 28320132  |                             |
| A804       | Knob-Tone                  |                   | 4    | 28320131  |                             |
| A805       | Button-Power               |                   | 1    | 28320130  |                             |

| PARTS NO.  | DESCRIPTION               | SPECIFICATIONS          | Q'TY | STOCK NO.  | REMARKS              |
|------------|---------------------------|-------------------------|------|------------|----------------------|
| A806       | Button-Push               |                         | 5    | 28320133   |                      |
| A808       | Button-Push               |                         | 4    | 28320134   |                      |
| A632       | Bottom-Board              |                         | 1    | 27170013A  |                      |
| A633       | Bottom-Cushion            |                         | 4    | 280889     |                      |
| A851       | Master Carton Box         |                         | 1    | 29050054   |                      |
| A852       | Pad-Right                 |                         | 1    | 29090115A  |                      |
| A853       | Pad-Left                  |                         | 1    | 29090116A  |                      |
| A854       | Poly Bag                  | 720X1020                | 1    | 29100020   |                      |
| A864       | Poly Bag                  |                         | 1    | 29100006A  |                      |
| A856       | Poly Bag                  | 80X150                  | 1    | 29100002   |                      |
| A857       | Sheet                     | 500X1200                | 1    | 290093     |                      |
| A880       | Instruction Manual        |                         | 1    | 29340125   |                      |
| A881       | Warranty Card             |                         | 1    | 293036-1   |                      |
| A882       | Caution Card              |                         | 1    | 293041     |                      |
| A883       | Caution Label A           |                         | 1    | 282969     |                      |
| A884       | Caution Card              |                         | 1    | 29355036-1 |                      |
| A885       | Tag-Cabinet Composition   |                         | 1    | 29380004   |                      |
| A887       | Tag-Sensor                |                         | 1    | 29355039   |                      |
| A901       | Silicon Cloth             |                         | 1    | 292017-2   |                      |
| A902       | FM Antenna                | 5059-01                 | 1    | 292064     |                      |
| A904       | Fuse                      | 4A (ST-2)               | 1    | 252038     |                      |
| (NAEQ-338) |                           |                         |      |            |                      |
| Q301, Q401 | Transistor                | 2SA722(S) or 2SA841(GR) | 2    | 210015     |                      |
| Q302, Q402 | Transistor                | 2SC1681(O-1) or (O-2)   | 2    | 210015     |                      |
| Q303, Q403 | Transistor                | 2SC1124(D)              | 2    | 2200101    |                      |
| D301, D401 | Diode-Silicon             | 1S1555                  | 2    | 223105     |                      |
| C304, C404 | Capacitor-Elect.          | CE04W25V33µF            | 2    | 352753301  |                      |
| C305, C405 | Capacitor-Elect.          | CE04W10V7µF             | 2    | 352734701  |                      |
| C312, C412 | Capacitor-Elect.          | CE04W25V90µF            | 2    | 352751011  |                      |
| C313, C413 | Capacitor-Elect.          | CE04W6.3V220µF          | 2    | 352722211  |                      |
| C314, C414 | Capacitor-Elect.          | CE04W50V47µF            | 2    | 352784791  |                      |
| C301, C401 | Capacitor-UL              | UL125V103M              | 2    | 350403     |                      |
| R316, R416 | Resistor-Metal Oxide Film | RS1WB1.8K               | 2    | 441621525  |                      |
| R908       | Resistor-Metal Oxide Film | RS1WB1.2K               | 1    | 441622714  |                      |
| S801a-h    | Switch-Rotary             | NRS-134BOK              | 1    | 25030061   | Selector             |
| S806a, b   | Switch-Push               | NPS-122A7               | 1    | 25035029   | Muting               |
| (NASW-339) |                           |                         |      |            |                      |
| S802       | Push Switch               | NPS-122B-142LA          | 1    | 25035030   |                      |
| P803       | Pin Jack                  | NTM-4PBL-E1             | 1    | 25045014   |                      |
| P804, P805 | Pin Jack                  | NTM-6PBL-E1             | 2    | 25045019   |                      |
| (NAAF-340) |                           |                         |      |            |                      |
| Q304, Q404 | Transistor                | 2SA722(S) or 2SA841(GR) | 2    | 210015     |                      |
| Q305, Q405 | Transistor                | 2SC1681(O-1) or (O-2)   | 2    | 210015     |                      |
| Q306, Q406 | Transistor                | 2SC1124(D)              | 2    | 2200101    |                      |
| C354, C454 | Capacitor-Elect.          | CE04W25V33µF            | 1    | 352753301  |                      |
| C355, C455 | Capacitor-Elect.          | CE04W16V7µF             | 1    | 352744701  |                      |
| C357, C457 | Capacitor-Elect.          | CE04W10V3µF             | 1    | 352733301  |                      |
| C358, C458 | Capacitor-Elect.          | CE04W50V3µF             | 1    | 352780331  |                      |
| C362, C462 | Capacitor-Elect.          | CE04W.05µF              | 1    | 352780101  |                      |
| C364, C464 | Capacitor-Elect.          | CE04W10V7µF             | 1    | 352734701  |                      |
| C365, C465 | Capacitor-Elect.          | CE04W50V47µF            | 1    | 352784791  |                      |
| C371, C471 | Capacitor-Elect.          | CE04W25V470µF           | 2    | 352754711  |                      |
| C352, C452 | Capacitor-DE              | DE93M30473µF            | 2    | 374124735  |                      |
| C353, C453 | Capacitor-UL              | UL125V103M              | 2    | 350403     |                      |
| R356, R456 | Resistor-Variable         | N24RGP20KBT30-41C       | 2    | 5172042    | VOLUME               |
| R357, R457 | Resistor-Variable         | N24RGP10KB30-21C        | 4    | 5172044    | ZONE                 |
| R382, R482 | Resistor-Variable         | N24RGP10KMN30-C         | 2    | 5172043    | BALANCE              |
| S807-S810  | Switch-Push               | NPS-122ALA              | 1    | 25035033   | Loudness Mode Filter |
| (NADA-341) |                           |                         |      |            |                      |
| Q501, Q601 | Transistor                | 2SC1681(O-1) or (O-2)   | 4    | 210015     |                      |
| Q503, Q603 | Transistor                | 2SA706(O-4)             | 2    | 2200033    |                      |
| Q504, Q604 | Transistor                | 2SC945(L-P)             | 2    | 2210743    |                      |
| Q505, Q605 | Transistor                | 2SC1625(O) or (Y)       | 2    | 2200101    |                      |
| Q506, Q606 | Transistor                | 2SA815(C or (Y)         | 2    | 2200101    |                      |
| D503       | Diode-Silicon             | 1S1555                  | 6    | 223105     |                      |
| C503, C603 | Capacitor-Elect.          | CE04W10V47µF            | 2    | 352734701  |                      |
| C508, C608 | Capacitor-Elect.          | CE04W6.3V47µF           | 2    | 352724711  |                      |
| C510, C610 | Capacitor-Elect.          | CE04W10V100µF           | 2    | 352791011  |                      |

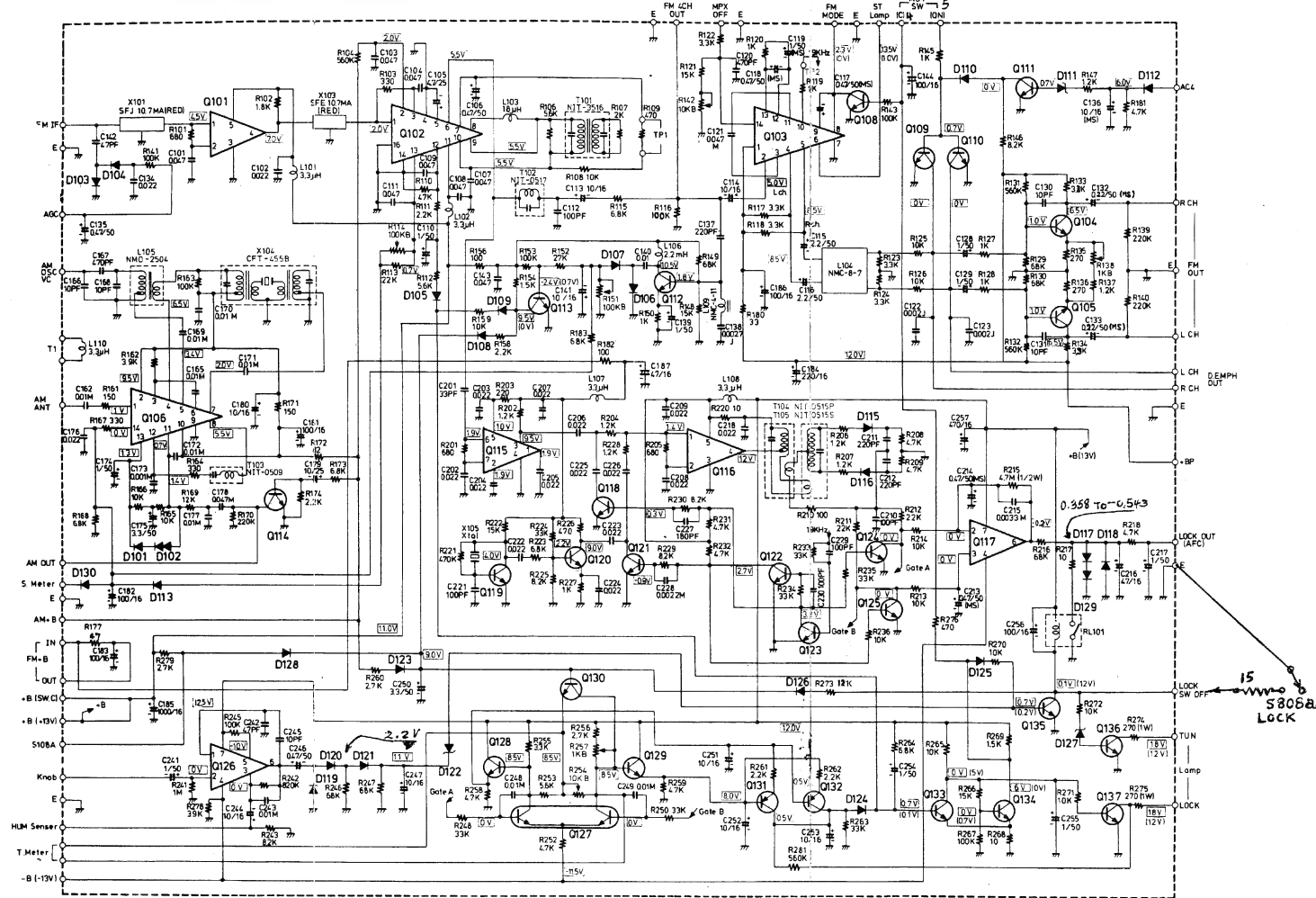
| PARTS NO.    | DESCRIPTION               | SPECIFICATIONS        | Q'TY | STOCK NO.                 | REMARKS   |
|--------------|---------------------------|-----------------------|------|---------------------------|-----------|
| C513, C613   | Capacitor-Elect.          | CE04W6.3V220µF        | 2    | 352722211                 |           |
| C516, C616   | Capacitor-DE              | DE93M30V154M          | 2    | 374121547                 |           |
| C519, C619   | Capacitor-DE              | DE93M30V104K          | 2    | 374121045                 |           |
| C501, C601   | Capacitor-UL              | UL125V103M            | 2    | 350403                    |           |
| R504, R604   | Resistor-Semi Fixed       | R-HK4 7KB3S           | 2    | 5221008                   |           |
| R518, R618   | Resistor-Semi Fixed       | R-HK1KB3S             | 2    | 5221017                   |           |
| R537, R637   | Resistor-Semi Fixed       | R-HK2.2KB3S           | 2    | 5221007                   |           |
| R513         | Resistor-Metal Oxide Film | RS1WB3.3K             | 2    | 441623324                 |           |
| R514         | Resistor-Metal Oxide Film | RS1WB1820             | 2    | 441628214                 |           |
| R515         | Resistor-Metal Oxide Film | RS1WB1.8K             | 2    | 441621824                 |           |
| R517         | Termistor                 | D22A                  | 2    | 4000003                   |           |
| R522         | Resistor-Metal Film       | RNU1WCJ10             | 2    | 451631004                 |           |
| R529         | Resistor-Metal Film       | RNU2WCJ10             | 2    | 451731004                 |           |
| R530, R531   | Resistor-Metal Film       | RNU1WCJ2.7            | 4    | 451630274                 |           |
| R532         | Resistor-Metal Film       | RNU1WCJ6.8            | 2    | 451630684                 |           |
| R538, R540   | Resistor-Cement           | RSS5WK0.47            | 4    | 48114795                  |           |
| R540, R542   | Radiator                  | RAD-O1                | 6    | 270187-1                  |           |
| L501, L601   | Coil-S                    | S-1.3B                | 2    | 231001                    |           |
| (NNAP-342)   |                           |                       |      |                           |           |
| Q701, Q705   | Transistor                | 2SA841(GR) or (BL)    | 3    | 210015                    |           |
| Q704, Q705   | Transistor                | 2SC1681(O-1) or (O-2) | 2    | 210015                    |           |
| Q706         | Transistor                | 2SC1625(Y)            | 1    | 2200394                   |           |
| Q901         | Transistor                | 2SD235(Y)             | 1    | 2200014                   |           |
| Q902, Q904   | Transistor                | 2SD234(O) or (Y)      | 2    | 2200101                   |           |
| Q903         | Transistor                | 2SC945(L-P)           | 1    | 2210073, 2210074, 2210015 |           |
| Q905         | Transistor                | 2SC945(L-P)           | 1    | 2210743                   |           |
| D701-D703    | Diode-Silicon             | 1S1554                | 5    | 223106                    |           |
| D708         | Diode-Zener               | WZ-061 or RD5.6E(C)   | 1    | 223916                    |           |
| D709         | Diode-Zener               | WZ-240                | 1    | 223916                    |           |
| D901, D902   | Diode-Silicon             | 1S1885 or 10D1        | 2    | 223916                    |           |
| D903, D904   | Diode-Silicon             | SR3AM-6B              | 4    | 223815                    |           |
| D907, D908   | Diode-Silicon             | 10D2                  | 2    | 223805                    |           |
| D909         | Diode-Zener               | WZ-130                | 1    | 223924                    |           |
| D910         | Diode-Zener               | WZ-240 or RD24E(B)    | 1    | 223916                    |           |
| D911, D912   | Diode-Silicon             | 1S1555                | 2    | 223105                    |           |
| D913         | Diode-Zener               | WZ-120 or RD12E(B)    | 1    | 223916                    |           |
| C701, C702   | Capacitor-Elect.          | CE04W50V330µF         | 2    | 352783311                 |           |
| C706         | Capacitor-Elect.          | CE04W16V330µF         | 1    | 352743311                 |           |
| C903         | Capacitor-Elect.          | CE04W25V470µF         | 1    | 352754711                 |           |
| C904         | Capacitor-Elect.          | CE04W25V220µF         | 1    | 352752211                 |           |
| C905, C923   | Capacitor-Elect.          | CE04W16V470µF         | 2    | 352744711                 |           |
| C906         | Capacitor-Elect.          | CE04W16V220µF         | 1    | 352742211                 |           |
| C907, C918   | Capacitor-Elect.          | CE04W35V100µF         | 2    | 352761011                 |           |
| C910         | Capacitor-Elect.          | CE04W50V100µF         | 1    | 352781011                 |           |
| C917, C918   | Capacitor-Elect.          | CE04W35V220µF         | 3    | 352762211                 |           |
| R717         | Resistor-Metal Oxide Film | RS1WB1.8K             | 1    | 441621814                 |           |
| R718         | Resistor-Metal Oxide Film | RS1WB1J50             | 1    | 441621514                 |           |
| R902         | Resistor-Metal Oxide Film | RS1WB1J00             | 1    | 441621014                 |           |
| R903         | Resistor-Metal Oxide Film | RS1WB1J20             | 1    | 441621214                 |           |
| R904         | Resistor-Metal Oxide Film | RS1WB1J680            | 1    | 441626814                 |           |
| R901         | Resistor-Metal Film       | RNU1WCJ8.2            | 1    | 451630824                 |           |
| R919         | Resistor-Metal Oxide Film | RS2WB1.8K             | 1    | 441721824                 |           |
| R920         | Resistor-Metal Oxide Film | RS1WB1J1K             | 1    | 441621024                 |           |
| R921         | Resistor-Metal Oxide Film | RS1WB1J820            | 1    | 441628214                 |           |
| F902         | Fuse                      | 5A-T                  | 1    | 252020                    |           |
| F902a        | Fuse Holder               | SN5051                | 2    | 250113                    |           |
| RL701        | Relay                     | NRL2PSADC24           | 1    | 25065015                  | 1/50      |
|              | Radiator                  | RAD-O1                | 4    | 270187-1                  |           |
| (NAPL-343)   |                           |                       |      |                           |           |
| PL801-PL804  | Pilot Lamp                | 6.3V0.25A             | 4    | 210026                    | Fuse type |
| PL808-PL814  | Pilot Lamp                | 6.3V0.05A             | 7    | 210027                    |           |
|              | Fuse Holder               | SN5051                | 8    | 250113                    |           |
| (NAPL-344)   |                           |                       |      |                           |           |
| PL805, PL806 | Pilot Lamp                | 6.3V0.25A             | 2    | 210026                    |           |
|              | Fuse Holder               | SN5051                | 4    | 250113                    |           |



# TX-4500 CIRCUIT DIAGRAM



# NAIMX-337(TX-4500) CIRCUIT DIAGRAM

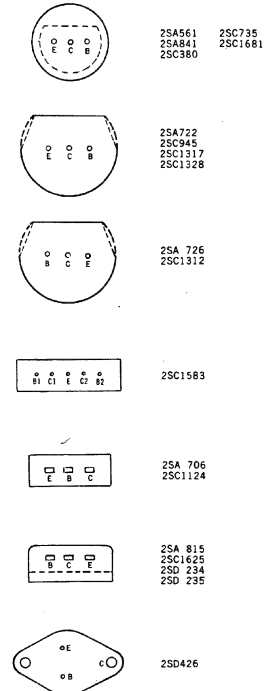


Q101, Q116 ..... TA7060P  
 Q102 ..... HA1137  
 Q103 ..... HA1156W  
 Q104, Q105 ..... 2SC1312 (F)  
 Q106 ..... HA1151  
 Q108, Q111, Q114 ..... 2SC945 (L)  
 Q109, Q110, Q118, Q130 ..... 2SC1317 (R) or 2SC735 (V)  
 Q121-Q125, Q133-Q137 ..... 2SC733 (BL)  
 Q115 ..... TA7061AP  
 Q117 ..... TA7504S  
 Q119, Q120 ..... 2SC38010  
 Q126 ..... TA7136P  
 Q127 ..... 2SC1583G  
 Q131, Q132 ..... 2SA726 (F)

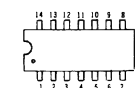
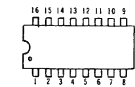
D101, D105, D110, D118 ..... 1S1555  
 D121, D124, D125, D128 ..... VD1212  
 D102 ..... VD1212  
 D103, D104, D106-Q109 ..... IN60  
 D112-D117, D119, D120 ..... WZ051 or RD51EB  
 D122 ..... YZ 047 or RD47EB  
 D127 ..... WZ061 or RD56EC

NOTES  
 ALL RESISTORS ARE IN OHMS, 1/4WATT UNLESS OTHERWISE NOTED.  
 ALL CAPACITORS ARE IN  $\mu$ F, 500V UNLESS OTHERWISE NOTED.  
 ELECTROLYTIC CAPACITORS (E) ARE IN  $\mu$ F/VV.  
 VOLTAGE (MEASURED WITH V.T.M.)  
 (V) DC VOLTAGE (NO INPUT SIGNAL).  
 (V) AC VOLTAGE (FM STEREO)

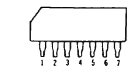
## Semiconductors Bottom View



## IC PIN NO. TOP VIEW



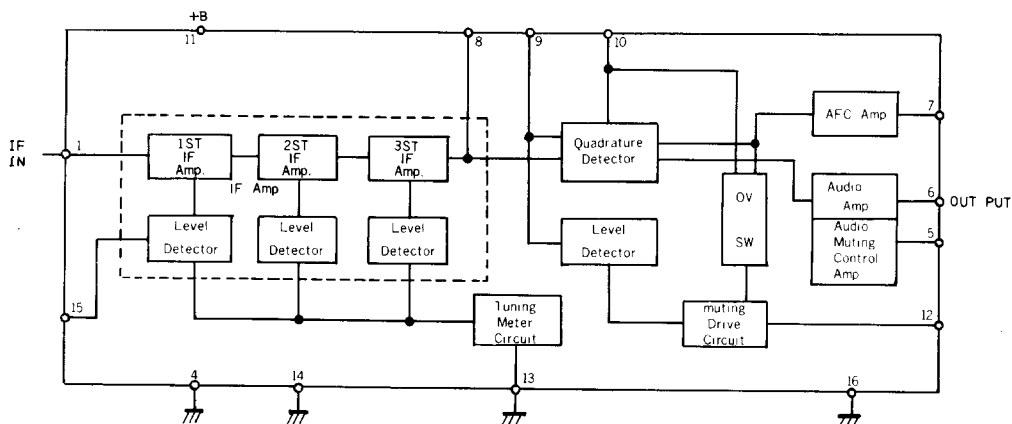
## PIN NO.



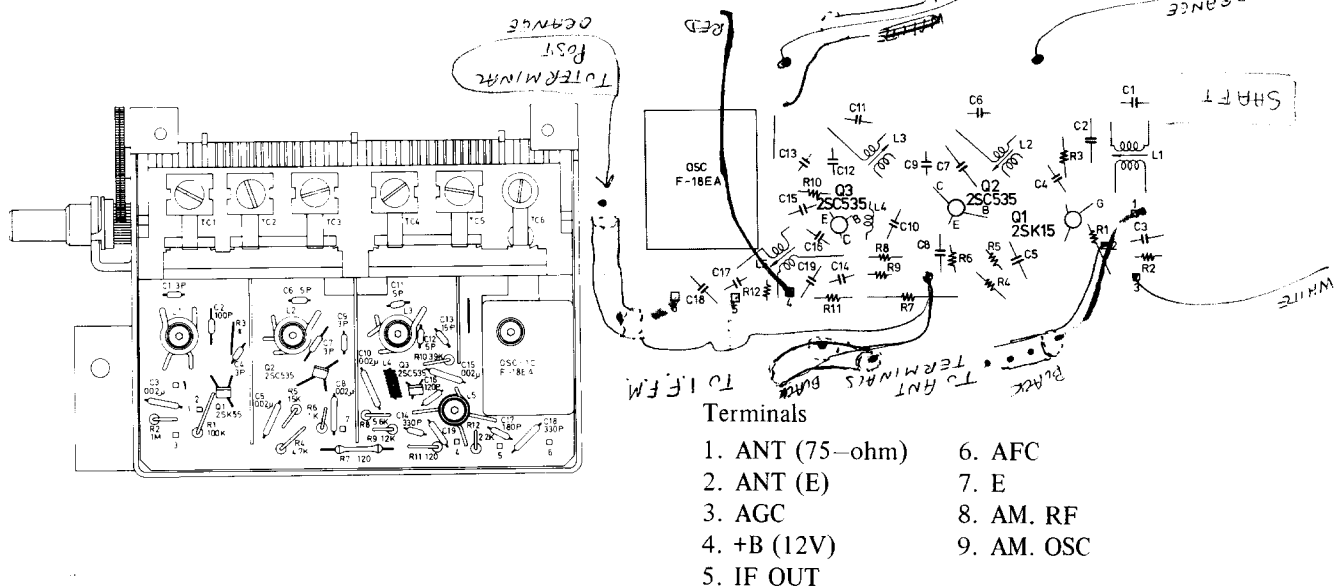
## NAIMX-337 PARTS LIST

| PARTS NO.  | DESCRIPTION                  | SPECIFICATIONS                 | Q'TY | STOCK NO.              | REMARKS             |
|--|------------------------------|--------------------------------|------|------------------------|---------------------|
| Q101, Q116   | IC                           | TA-7060P                       | 2    | 222407                 | FM IF Amp           |
| Q102   | IC                           | HA-1137W                       | 1    | 222421                 | FM DET              |
| Q103   | IC                           | HA-1156                        | 1    | 222419                 | FM MPX              |
| Q106   | IC                           | HA-1151                        | 1    | 222418                 | AM                  |
| Q115   | IC                           | TA-7061AP                      | 1    | 222402                 | FM IF Amp           |
| Q117   | IC                           | TA-7504S                       | 1    | 222424                 | OP Amp              |
| Q126   | IC                           | TA-7136P                       | 1    | 222423                 | Sensor Amp          |
| Q104, Q105   | Transistor                   | 2SC1312(F)                     | 2    | 2210136                |                     |
| Q108, Q111, Q114   | Transistor                   | 2SC945 ① Q1                    | 3    | 2210745                |                     |
| Q109, Q110, Q118, Q121, Q125<br>Q130, Q133, Q137                   | Transistor                   | 2SC735(Y) or 2SC1317(R)        | 14   | 2210244 or 2210943     |                     |
| Q112, Q113, Q128, Q129   | Transistor                   | 2SC733(BL)                     | 4    | 2210086                |                     |
| Q119, Q120   | Transistor                   | 2SC380(O)                      | 2    | 2210123                |                     |
| Q127   | Transistor                   | 2SC1583(G)                     | 1    | 2210707                |                     |
| Q131, Q132   | Transistor                   | 2SA726(F)                      | 2    | 2210416                |                     |
| D101, D105, D110, D118, D121<br>D124, D125, D128                   | Diode-Silicon                | 1S1555                         | 8    | 223105                 |                     |
| D102   | Varistor                     | VD1212                         | 1    | 4000022                |                     |
| D103, D104, D108, D109, D112, D117<br>D119, D120, D123, D126, D129 | Diode-Germanium              | 1N60 ⑧ FM                      | 16   | 2231031                |                     |
| D111   | Diode-Silicon                | RD5.1EB or WZ-052              | 1    | 223945 or 224012       |                     |
| D122   | Diode-Silicon                | RD4.7EB or YZ047               | 1    | 223943 or 224011       |                     |
| D127   | Diode-Silicon                | RD5.6EC or WZ-061              | 1    | 223948 or 223928       |                     |
| L101, L102, L107, L108, L110                                       | Choke Coil                   | NCCH-1501                      | 5    | 233204                 | 3.3μH               |
| L103   | Choke Coil                   | NCCH-1506                      | 1    | 233074                 |                     |
| L104   | Coil-MPX                     | NMC-8-7                        | 1    | 233032                 | Low Pass Filter     |
| L105   | Coil-OSC                     | NMO-2504                       | 1    | 232042                 | AM OSC              |
| L106   | Coil-MPX                     | NMC-9-1                        | 1    | 233031                 | 2.2μH               |
| L109   | Coil-MPX                     | NMC-4-11                       | 1    | 233018                 |                     |
| T101   | Transformer-IF               | NIT-3516                       | 1    | 233083                 | Quadrature Detector |
| T102   | Transformer-IF               | NIT-0517                       | 1    | 233084                 | 10.7MHz Trap        |
| T103   | Transformer-IF               | NIT-0509                       | 1    | 232041                 | AM DET              |
| T104   | Transformer-IF               | NIT-0515P                      | 1    | 233078                 | FM DET              |
| T105   | Transformer-IF               | NIT-0515S                      | 1    | 233079                 | FM DET              |
| X101   | Ceramic Filter               | SFJ10.7MA                      | 1    | 3010018                | (RED)               |
| X103   | Ceramic Filter               | SFE10.7MA                      | 1    | 3010006                | (RED)               |
| X104   | Ceramic Filter               | CFT-455B                       | 1    | 3010012                |                     |
| X105   | Crystal Oscillator           | XTL-10.7M                      | 1    | 3010015                |                     |
| C105   | Capacitor-Elect.             | CE04W25V4.7S                   | 1    | 352750471              |                     |
| C106, C132, C133, C135, C246                                       | Capacitor-Elect.             | CE04W50V0.47S                  | 5    | 352784791              |                     |
| C124, C212, C241, C110, C128<br>C129, C139, C254, C255             | Capacitor-Elect.             | CE04W50V1S                     | 9    | 352780101              |                     |
| C113, C114, C141, C180, C244<br>C245, C253                         | Capacitor-Elect.             | CE04W16V10S                    | 7    | 352741001              |                     |
| C115, C116   | Capacitor-Elect.             | CE04W50V2.2S                   | 2    | 352780221              |                     |
| C175, C250   | Capacitor-Elect.             | CE04W50V3.3S                   | 2    | 352780331              |                     |
| C179, C251, C252   | Capacitor-Elect.             | CE04W25V10S                    | 3    | 352751001              |                     |
| C181, C182, C183, C186, C256                                       | Capacitor-Elect.             | CE04W16V100S                   | 5    | 352741011              |                     |
| C184   | Capacitor-Elect.             | CE04W16V220S                   | 1    | 352742211              |                     |
| C185   | Capacitor-Elect.             | CE04W16V1000S                  | 1    | 352741021              |                     |
| C187, C216   | Capacitor-Elect.             | CE04W16V47S                    | 2    | 352744701              |                     |
| C257   | Capacitor-Elect.             | CE04W16V470S                   | 1    | 352744711              |                     |
| C117, C118   | Capacitor-MS                 | MS04C50V0.47M                  | 2    | 392084797              |                     |
| C119   | Capacitor-MS                 | MS04C50V1M                     | 1    | 392080107              |                     |
| C136   | Capacitor-MS                 | MS04C16V10M                    | 1    | 3920410007             |                     |
| C121, C178   | Capacitor-DE                 | DE93M50V473M                   | 2    | 374124737              |                     |
| C213, C214   | Capacitor-MS or Capacitor-LR | MS04C50V0.47M or LR04B50V0.47S | 2    | 392084797 or 392684791 |                     |
| R114   | Resistor-Semi Fixed          | R-HK100KB3P                    | 1    | 5225013                |                     |
| R138, R257   | Resistor-Semi Fixed          | R-HK1KB3P                      | 2    | 5225018                |                     |
| R142   | Resistor-Semi Fixed          | R-HK4.7KBD                     | 1    | 5225019                |                     |
| R151   | Resistor-Semi Fixed          | R-HK100KB3M                    | 1    | 5225016                |                     |
| R254   | Resistor-Semi Fixed          | R-HK10KB3P                     | 1    | 5225017                |                     |
| R274, R275   | Resistor-Metal Oxide Film    | RS1WBJ270                      | 2    | 441622714              |                     |
| RL101  | Relay                        | L-13                           | 1    | 25065026               | AFC                 |

## HA-1137W BLOCK DIAGRAM

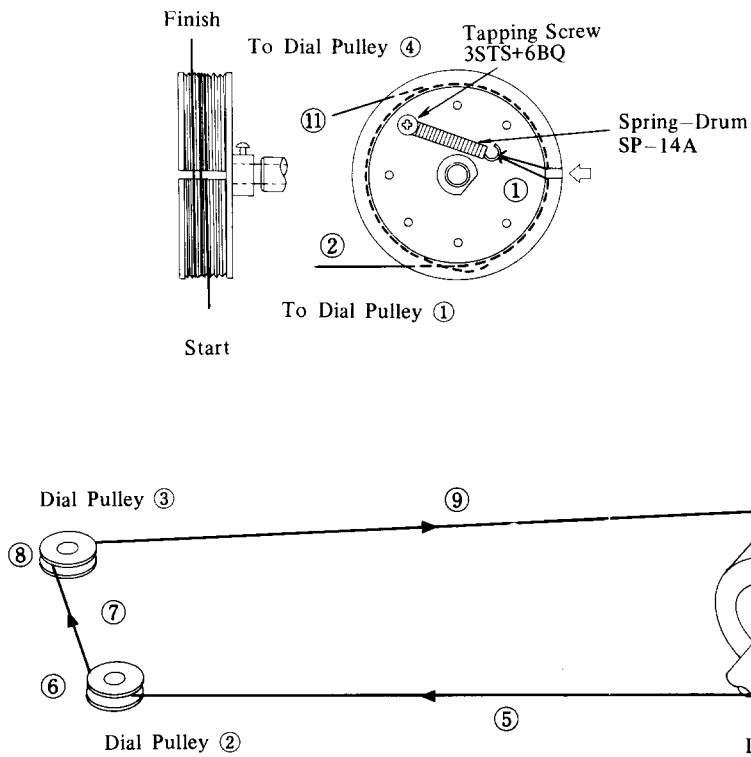


**FM FRONT END BOARD VIEW**  
**FAT-42EJ-41(TX-4500)**  
**TOP VIEW**

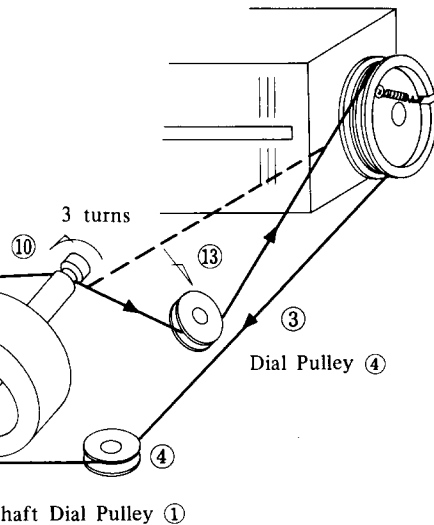


| PARTS NO. | DESCRIPTION      | SPECIFICATIONS | Q'TY | STOCK NO. | REMARKS |
|-----------|------------------|----------------|------|-----------|---------|
| Q1        | Transistor (FET) | 2SK55(D)       | 1    | 2210954   | RF Amp. |
| Q2        | Transistor       | 2SC535(B)      | 1    | 2210882   | RF Amp. |
| Q3        | Transistor       | 2SC535(B)      | 1    | 2210882   | Mixer   |
|           | OSC Block        | F-18EA         | 1    | 222009    |         |

## DIAL CORD ARRANGEMENT



1. Close the variable capacitor complete and tie dial cord to the spring of the drum.
2. Thread dial cord in the direction of arrow from ① to ⑨ and wind dial cord three turns around the tuning shaft clockwise.
3. Thread dial cord in the direction of arrow from ⑩ to ⑫.
4. Thread dial cord to the dial pulley ④.

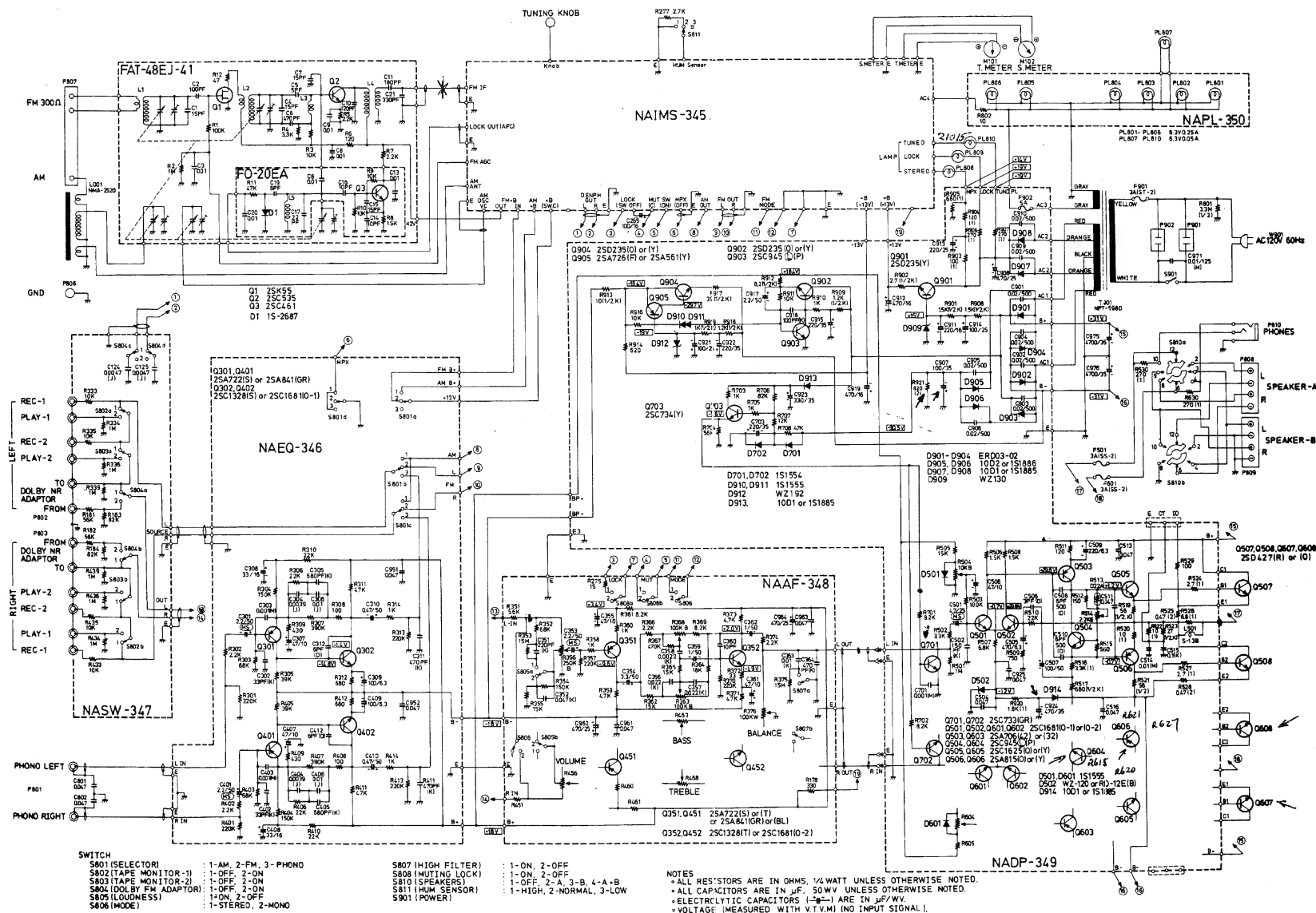


# TX-2500 PARTS LIST

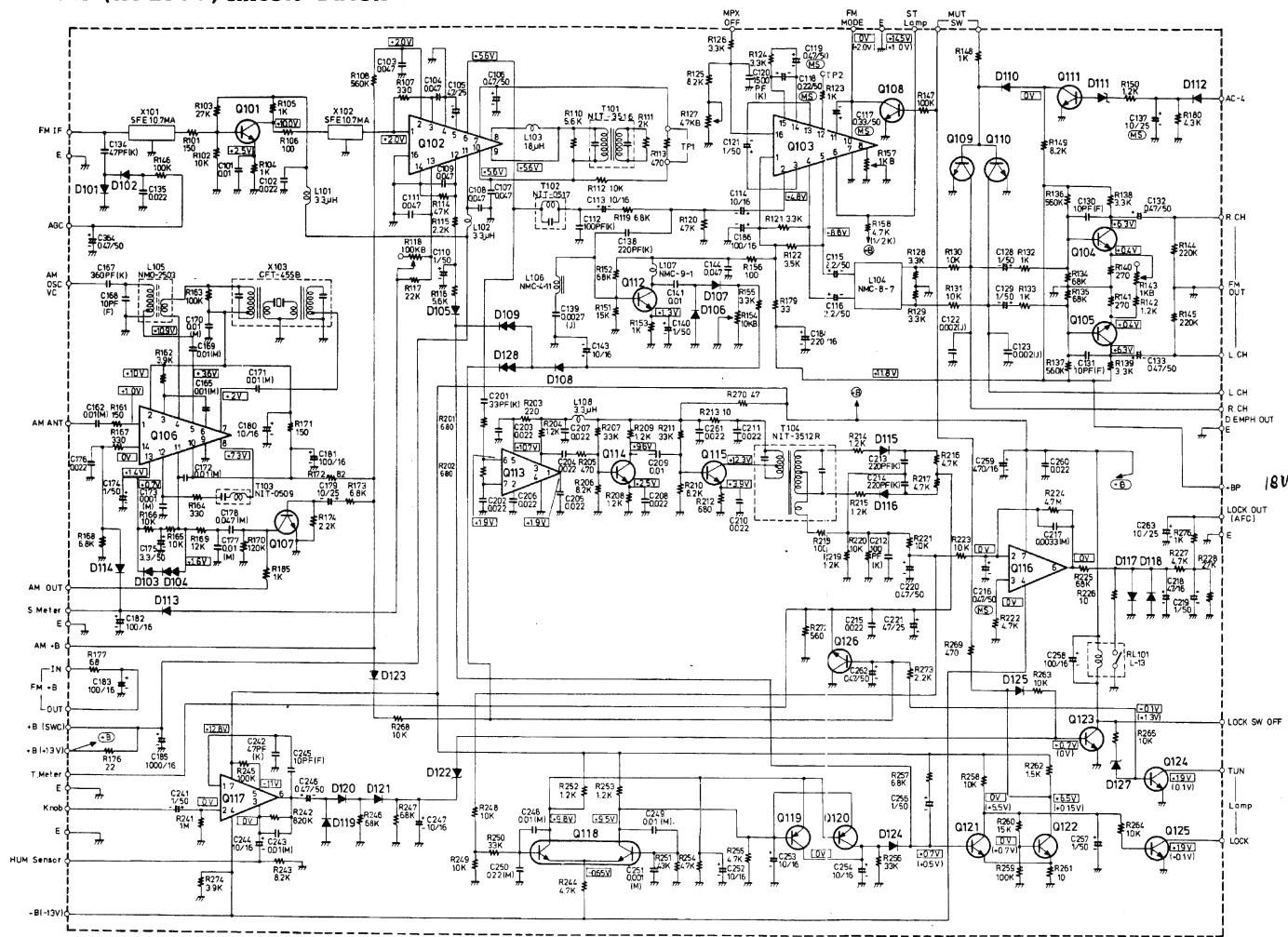
| PARTS NO.                    | DESCRIPTION                     | SPECIFICATIONS                    | Q'TY | STOCK NO.                 | REMARKS            |
|------------------------------|---------------------------------|-----------------------------------|------|---------------------------|--------------------|
|                              | FM Front End                    | FAT-48EJ-41                       | 1    | 240036                    |                    |
|                              | Printed Circuit Board Ass'y     | NAIMS-345                         | 1    | 13809545                  | Tuner Ass'y        |
|                              | Printed Circuit Board Ass'y     | NAEQ-346                          | 1    | 13809546                  | Equalizer Ass'y    |
|                              | Printed Circuit Board Ass'y     | NASW-347                          | 1    | 13809547                  | Switch Ass'y       |
|                              | Printed Circuit Board Ass'y     | NAAF-348                          | 1    | 13809548                  | Tone Ass'y         |
|                              | Printed Circuit Board Ass'y     | NADP-349                          | 1    | 13809549                  | Driver Ass'y       |
|                              | Printed Circuit Board Ass'y     | NAPL-350                          | 1    | 13809550                  | Pilot Lamp Ass'y   |
| Q507, Q508, Q607, Q608       | Transistor                      | 2SD427(R) or 2SD427(O)            | 4    | 2200372 or 2200373        | Use same hfe rank. |
| PL807-PL810                  | Pilot Lamp                      | 6.3V0.05AW3                       | 4    | 210015                    | Dial illumination  |
| T901                         | Transformer-Power               | NPT-598D                          | 1    | 230156                    |                    |
| L001                         | Coil-Antenna                    | NMA-2520                          | 1    | 232054                    | AM BAR ANTENNA     |
| C971                         | Capacitor-UL                    | UL125V10000pF                     | 1    | 3504012                   |                    |
| C975, C976                   | Capacitor-Elect.                | CE62W35V4700μF                    | 2    | 3504081                   |                    |
| C265                         | Capacitor-Elect.                | CE04W16V100μF                     | 1    | 352741011                 |                    |
| R530, R630                   | Resistor-Metal Oxide Film       | RS1WBJ270ohm                      | 2    | 441622714                 |                    |
| S901                         | Switch-Push                     | NPS-111LN5                        | 1    | 25035025                  | Power Source       |
| S810                         | Switch-Rotary                   | NRS-244-30Y                       | 1    | 25030059                  | SPEAKERS           |
| S811                         | Switch-Slide                    | NSS-2327                          | 1    | 25065016                  | HUM SENSOR         |
| P801                         | Pin Jack                        | NTM-2WPHL-E1                      | 1    | 250170                    | Phono              |
| P807                         | Terminal                        | NTM-3WPUN1                        | 1    | 25060020                  | Antenna            |
| P808, P809                   | Terminal-Speaker                | NTM-4WPUN1                        | 2    | 25060001A                 |                    |
| P810                         | Jack-Stereo Headphone           | LJ-100-H                          | 1    | 25045018                  |                    |
| P901, P902                   | Socket-AC                       | S-16432                           | 2    | 25050008A                 |                    |
| W901                         | Power Supply Cord               | AS-UC                             | 1    | 253072                    |                    |
| F901                         | Fuse                            | ST-2 3A                           | 1    | 252005                    | Power Source       |
| F901a                        | Fuse Holder                     | S-N1301                           | 1    | 250080                    |                    |
| F501, F601                   | Fuse                            | SS-2 3A                           | 2    | 252006                    | Speaker            |
| F601a                        | Fuse Holder                     |                                   | 1    | 25050004                  | with COVER         |
| M101                         | Tuning Indicator                | NIND-0250S52                      | 1    | 243053                    | Strength           |
| M102                         | Tuning Indicator                | NIND-0500S55                      | 1    | 243056                    | Tuning             |
| Q507a, Q607a<br>Q508a, Q608a | Socket-Transistor               | M1614                             | 4    | 250249                    |                    |
|                              | Binder                          | SKB-1                             | 20   | 260208                    |                    |
| A001                         | Chassis                         |                                   | 1    | 27100014B                 |                    |
| A003                         | Dial Drum                       |                                   | 1    | 27200019                  |                    |
| A004                         | Spring-Drum                     | SP-14A                            | 1    | 273803                    |                    |
| A005                         | Dial Cord                       |                                   |      | 273903                    |                    |
| A007                         | Shaft-Push Switch               |                                   | 3    | 27260005                  |                    |
| A009                         | Joint                           |                                   | 3    | 28320135                  | Push Switch        |
| A032                         | Bracket-Dial Pulley (R)         |                                   | 1    | 27140084                  |                    |
| A033                         | Bracket-Dial Pulley (L)         |                                   | 2    | 27140083                  |                    |
| A034                         | Dial Pulley                     | DP-16N                            | 4    | 27185002                  |                    |
| A040                         | Bracket-Front                   |                                   | 1    | 27110024B                 |                    |
| A041                         | Drive Shaft                     |                                   | 1    | 27205005                  |                    |
| A073                         | Back Panel                      |                                   | 1    | 27120040                  |                    |
| A074                         | Bracket-Antenna                 |                                   | 1    | 27140091                  |                    |
| A075                         | Holder-Antenna                  | 1                                 | 1    | 27190015A                 |                    |
| A078                         | Heat Sink                       |                                   | 1    | 27160016A                 |                    |
| A301                         | Amp. Box Ass'y                  |                                   | 1    | 28110058B                 |                    |
| A302                         | Screw                           | 4MS+15BS-Ni                       | 4    | 82374015                  |                    |
| A303                         | Washer                          | 4X12BS-N                          | 4    | 870040                    |                    |
| ((NAEQ-346))                 |                                 |                                   |      |                           |                    |
| Q301, Q401                   | Transistor                      | 2SA722(S) or 2SA841(GR)           | 2    | 2210915 or 2210665        |                    |
| Q302, Q402                   | Transistor                      | 2SC1328(S) or 2SC1681(O-1)        | 2    | 2210925 or 2210670        |                    |
| C301, C401                   | Capacitor-LR or<br>Capacitor-MS | LR04B50V2.2μF or<br>MS04C50V2.2μF | 2    | 392680221 or<br>392080227 |                    |
| C307, C407                   | Capacitor-Elect.                | CE04W10V47μF                      | 2    | 352734701                 |                    |
| C308, C408                   | Capacitor-Elect.                | CE04W16V33μF                      | 2    | 352743301                 |                    |
| C309, C409                   | Capacitor-Elect.                | CE04W6.3V100μF                    | 2    | 352721011                 |                    |
| C310, C410                   | Capacitor-Elect.                | CE04W50V0.47μF                    | 2    | 352784791                 |                    |
| S801                         | Switch-Rotary                   | NRS-163-30K                       | 1    | 25030060                  | SELECTOR           |
| ((NASW-347))                 |                                 |                                   |      |                           |                    |
| P802, P803                   | Pin Jack                        | NTM-6PBL-E1                       | 2    | 25045019                  |                    |
| S802-S804                    | Switch-Push                     | NPS-122X2-142LA                   | 1    | 25035031                  | T. MONI & DOLBY    |
| ((NAAF-348))                 |                                 |                                   |      |                           |                    |
| Q351, Q451                   | Transistor                      | 2SA841(GR)                        | 2    | 2210665                   |                    |
|                              |                                 | 2SA841(BL)                        |      | 2210666                   |                    |
|                              |                                 | 2SA722(S)                         |      | 2210915 or                |                    |
|                              |                                 | 2SA722(T)                         |      | 2210916 or                |                    |
| Q352, Q452                   | Transistor                      | 2SC1681(O-2)                      | 2    | 2210671 or                |                    |
|                              |                                 | 2SC1328(T)                        |      | 2210926 or                |                    |

| PARTS NO.              | DESCRIPTION                  | SPECIFICATIONS                         | Q'TY | STOCK NO.              | REMARKS               |
|------------------------|------------------------------|--|------|------------------------|-----------------------|
| C352, C452             | Capacitor-DE                 | DE93M50V0.047μF                        | 2    | 374124735              |                       |
| C353, C453             | Capacitor-LR<br>Capacitor-MS | LR04B50V3.3μF<br>MS04C50V2.2μF         | 2    | 392680221<br>392080227 |                       |
| C354, C454             | Capacitor-Elect.             | CE04W50V3.3μF                          | 2    | 352780331              |                       |
| C355, C455             | Capacitor-Elect.             | CE04W10V47μF                           | 2    | 352734701              |                       |
| C361,C461,C359,C369    | Capacitor-Elect.             | CE04W50V1μF                            | 4    | 352780101              |                       |
| C962, C964             | Capacitor-Elect.             | CE04W25V470μF                          | 2    | 352754711              |                       |
| R356, R456             | Resistor-Variable            | N24RGP250KBT30.41C                     | 1    | 5172042                | VOLUME                |
| R363,R463,R368,R468    | Resistor-Variable            | N16RGM100KB30.11C                      | 2    | 5104036                | TONE                  |
| R376, R476             | Resistor-Variable            | N16RL100KW30C                          | 1    | 5104035                | BALANCE               |
| S805-S807              | Switch-Push                  | NPS-122X3LA                            | 1    | 25035032               | LOW & HI FILTER,DOLBY |
| S808                   | Switch-Push                  | NPS-122LA7                             | 1    | 25035029               | MUTING                |
| ((NADP-349))           |                              |  |      |                        |                       |
| Q501,Q502,Q601,Q602    | Transistor                   | 2SC1681(O) 1/2<br>2SC1681(O) 2 1/2     | 4    | 2210670 or 2210671     | Using same hfe rank   |
| Q503, Q603             | Transistor                   | 2SA706(42) or (32)                     | 2    | 2200033 or 2200034     |                       |
| Q504, Q604, Q903       | Transistor                   | 2SC945 L (P)                           | 3    | 2210743                |                       |
| Q505, Q605             | Transistor                   | 2SC1625(O) or 2SC1625(Y)               | 2    | 2200393 or 2200394     | Using same hfe rank   |
| Q506, Q606             | Transistor                   | 2SA815(O) or 2SA815(Y)                 | 2    | 2200403 or 2200404     | Using same hfe rank   |
| Q701, Q702             | Transistor                   | 2SC733(GR)                             | 2    | 2210085                |                       |
| Q703                   | Transistor                   | 2SC734(Y)                              | 1    | 2210064                |                       |
| Q901                   | Transistor                   | 2SD235(Y)                              | 1    | 2200014                |                       |
| Q902, Q904             | Transistor                   | 2SD235(O) or (Y)                       | 2    | 2200013 or 2200014     |                       |
| Q905                   | Transistor                   | 2SA726(F) or 2SA561(Y)                 | 1    | 2210416 or 2210074     |                       |
| D501,D601,D910,D911    | Diode-Silicon                | 1S1555                                 | 4    | 223105                 |                       |
| D502                   | Diode-Zener                  | WZ-120 or RD12E(B)                     | 1    | 223910 or 223963       |                       |
| D901-D904              | Diode-Silicon                | ERD03-02                               | 4    | 223832                 |                       |
| D905, D906             | Diode-Silicon                | 10D2                                   | 2    | 223805                 |                       |
| D907,D908,D913,D914    | Diode-Silicon                | 10D1 or 1S1885                         | 4    | 223801 or 223802       |                       |
| D909                   | Diode-Zener                  | WZ-130                                 | 1    | 223924                 |                       |
| D912                   | Diode-Zener                  | WZ-192                                 | 1    | 223927                 |                       |
| D701, D702             | Diode-Silicon                | 1S1554                                 | 2    | 223106                 |                       |
| L501, L601             | Coil-S                       | S-1.3B                                 | 2    | 231001                 |                       |
| C501, C601             | Capacitor MS or LR           | MS04C25V4.7μF 1/4<br>LR04B25V4.7μF 1/4 | 2    | 392650471<br>392050477 |                       |
| C503, C603             | Capacitor-Elect.             | CE04W10V47μF                           | 2    | 352734701              |                       |
| C505, C605             | Capacitor-Elect.             | CE04W6.3V470μF                         | 2    | 352724711              |                       |
| C507, C607             | Capacitor-Elect.             | CE04W50V100μF                          | 2    | 352781011              |                       |
| C509, C609             | Capacitor-Elect.             | CE04W6.3V220μF                         | 2    | 352722211              |                       |
| C515, C615             | Capacitor-DE                 | DE93M50V0.1μF                          | 2    | 374121045              |                       |
| C703, C915, C923       | Capacitor-Elect.             | CE04W35V220μF                          | 3    | 352762211              |                       |
| C907                   | Capacitor-Elect.             | CE04W35V100μF                          | 1    | 352761011              |                       |
| C908                   | Capacitor-Elect.             | CE04W25V470μF                          | 1    | 352754711              |                       |
| C911                   | Capacitor-Elect.             | CE04W16V220μF                          | 1    | 352742211              |                       |
| C912, C919             | Capacitor-Elect.             | CE04W16V470μF                          | 2    | 352744711              |                       |
| C913                   | Capacitor-Elect.             | CE04W25V220μF                          | 1    | 352752211              |                       |
| C914, C921             | Capacitor-Elect.             | CE04W25V100μF                          | 2    | 352751011              |                       |
| C917                   | Capacitor-Elect.             | CE04W50V2.2μF                          | 1    | 352780221              |                       |
| C924                   | Capacitor-Elect.             | CE04W35V470μF                          | 1    | 352764711              |                       |
| R504, R604             | Resistor-Semi Fixed          | R-HK4.7KB3M                            | 2    | 5225019                | Center Voltage        |
| R513, R613             | Thermistor                   | D-22A                                  | 2    | 4000003                |                       |
| R514, R614             | Resistor-Semi Fixed          | R-HK2.2KB3M                            | 2    | 5225005                | Idling Current        |
| R516, R616             | Resistor-Metal Oxide Film    | RS1WBJ3.3K ohm                         | 2    | 441623324              |                       |
| R520, R522, R620, R622 | Resistor-Metal Film          | RNU1WCJ10 ohm                          | 4    | 451631004              |                       |
| R524, R527, R624, R627 | Resistor-Metal Film          | RNU1WCJ2.7 ohm                         | 4    | 451630274              |                       |
| R525, R528, R625, R628 | Resistor-Metal Film          | RNU2WCJ0.47 ohm                        | 4    | 451734794              |                       |
| RQ526, RQ626           | Resistor-Metal Film          | RNU1WCJ6.8 ohm                         | 2    | 451630684              |                       |
| R903                   | Resistor-Metal Oxide Film    | RS1WBJ100 ohm                          | 1    | 441621014              |                       |
| R904                   | Resistor-Metal Oxide Film    | RS1WBJ120 ohm                          | 1    | 441621214              |                       |
| R905                   | Resistor-Metal Oxide Film    | RS1WBJ680 ohm                          | 1    | 441626814              |                       |
| R906, R907             | Resistor-Metal Oxide Film    | RS1WBJ270 ohm                          | 2    | 441622714              |                       |
| R920                   | Resistor-Metal Oxide Film    | RS1WBJ1.8K ohm                         | 1    | 441621824              |                       |
| R921                   | Resistor-Metal Oxide Film    | RS2WBJ820 ohm                          | 1    | 441728214              |                       |
|                        | Radiator                     | RAD-01                                 | 7    | 270187-1               |                       |
| F902                   | Fuse                         | 5A-T                                   | 1    | 252020                 |                       |
| F902a                  | Fuse Holder                  | SN5051                                 | 2    | 250113                 |                       |
| ((NAPL-350))           |                              |  |      |                        |                       |
| PL801-PL806            | Pilot Lamp                   | 6.3V0.25A                              | 6    | 210026                 |                       |
|                        | Fuse Holder                  | SN5051                                 | 12   | 250113                 |                       |

# TX-2500 CIRCUIT DIAGRAM



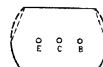
# NAIMS-345 (TX-2500) CIRCUIT DIAGRAM



## Semiconductors Bottom View



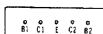
2SA561 2SC735  
2SA841 2SC1681  
2SC380



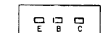
2SA722 2SC945  
2SC1317 2SC1328



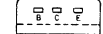
2SA 726 2SC1312



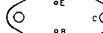
2SC1583



2SA 706 2SC1124

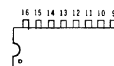


2SA 815 2SC1625  
2SD 234 2SD 235

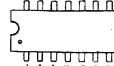


2SD426

## IC PIN NO. TOP VIEW



LA3350 HA1137



HA1151

## PIN NO.



TA75045 TA7136P TA7061AP

Q101, Q114, Q115 ----- 2SC380(O)  
Q102 ----- HA1137  
Q103 ----- LA-3350  
Q104, Q105 ----- 2SC1312(F)  
Q106 ----- HA1151  
Q107, Q108, Q111 ----- 2SC945(O)  
Q109, Q110, Q121-Q126 ----- 2SC1317(R) or 2SC735(I)  
Q112 ----- 2SC733(BL)  
Q113 ----- TA-7061AP  
Q116 ----- TA-7504S  
Q117 ----- TA-7136P  
Q118 ----- 2SC1583(G)  
Q119, Q120 ----- 2SA726(F)

D101, D102, D106, D107, D110, D112-D115, D108-1N60 (M)  
D119, D120, D123  
D103, D105, D117  
D118, D121, D124, D125-1S1555  
D104, D109, D128 ----- VD1212  
D122 ----- RD47EB or YZ-047  
D127 ----- RD56EC or WZ-061

## NOTES:

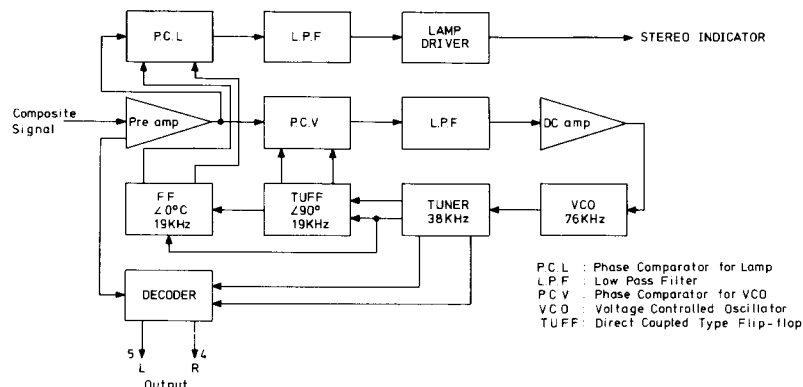
- ALL RESISTORS ARE IN OHMS, 1/4WATT UNLESS OTHERWISE NOTED.
- ALL CAPACITORS ARE IN  $\mu$ F, 50WV UNLESS OTHERWISE NOTED.
- ELECTROLYTIC CAPACITORS (E) ARE IN  $\mu$ F/WV
- VOL\*AGE (MEASURED WITH V.T.V.M)
- ( ) NO INPUT SIGNAL
- ( ) FM STEREO



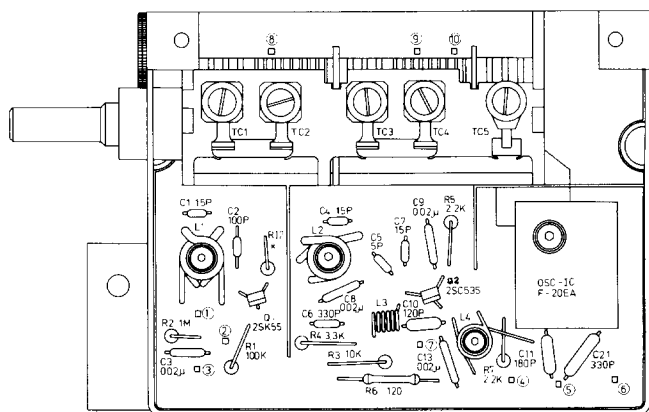
# NAIMS-345 PARTS LIST

| PARTS NO.  | DESCRIPTION         | SPECIFICATIONS                   | Q'TY | STOCK NO.                   | REMARKS             |
|--|---------------------|----------------------------------|------|-----------------------------|---------------------|
| Q101, Q114, Q115   | Transistor          | 2SC380(O)                        | 3    | 2210123                     |                     |
| Q104, Q105   | Transistor          | 2SC1312(F)                       | 2    | 2210136                     |                     |
| Q107, Q108, Q111   | Transistor          | 2SC945 (D) Q                     | 3    | 2210745                     |                     |
| Q109, Q110, Q121-Q126  | Transistor          | 2SC1317(R) or 2SC735(Y)          | 8    | 2210943 or 2210244          |                     |
| Q112   | Transistor          | 2SC733(BL)                       | 1    | 2210086                     |                     |
| Q118   | Transistor          | 2SC1583(G)                       | 1    | 2210707                     | Twin transistor     |
| Q119, Q120   | Transistor          | 2SA726(F)                        | 2    | 2210416                     |                     |
| Q102   | IC                  | HA-1137                          | 1    | 222421                      | Quadrature Detector |
| Q103   | IC                  | LA-3350                          | 1    | 222449                      | MPX IC              |
| Q106   | IC                  | HA-1151                          | 1    | 222418                      | AM IC               |
| Q113   | IC                  | TA-7061AP                        | 1    | 222402                      | FM IF IC            |
| Q116   | IC                  | TA-7504S                         | 1    | 222424                      | OP Amp              |
| Q117   | IC                  | TA-7136P                         | 1    | 222423                      | Sensor Amp          |
| D101, D102, D110, D106-D108<br>D112-D116, D119, D120, D121<br>D124, D125   | Diode-Germanium     | 1N60 (N) FM                      | 14   | 2231031                     |                     |
| D104, D109, D128   | Diode-Silicon       | 1S1555                           | 7    | 223105                      |                     |
| D111   | Varistor            | VD1212                           | 3    | 4000022                     |                     |
| D122   | Diode-Zener         | RD5.1EB or WZ-052                | 1    | 223945 or 224012            |                     |
| D127   | Diode-Zener         | RD4.7EB or YZ-047                | 1    | 223943 or 224011            |                     |
| L101, L102, L108   | Diode-Zener         | RD5.6EC or WZ-061                | 1    | 223948 or 223928            |                     |
| L103   | Choke Coil          | NCCH-1501 (3.3μH)                | 3    | 233024                      |                     |
| L104   | Choke Coil          | NCCH-1506 (18μH)                 | 1    | 233074                      |                     |
| L105   | MPX Coil            | NMC-8-7                          | 1    | 233032                      | Low Pass Filter     |
| L106   | OSC Coil            | NMO-2503                         | 1    | 232013                      | AM OSC Coil         |
| L107   | MPX Coil            | NMC-4-11                         | 1    | 233018                      |                     |
| T101   | MPX Coil            | NMC-9-1                          | 1    | 233031                      |                     |
| T102   | Transformer-IF      | NIT-3516                         | 1    | 233083                      | FM DET              |
| T103   | Transformer-IF      | NIT-0517                         | 1    | 233084                      | 10.7MHz Trap        |
| T104   | Transformer-IF      | NIT-0509                         | 1    | 232041                      | AM DET              |
| X101, X102   | Transformer-IF      | NIT-3512R                        | 1    | 233075                      | FM DET              |
| X103   | Ceramic Filter      | SFE10.7MA(BLUE, RED or ORANGE)   | 2    | 3010007, 3010006 or 3010008 | FM IF Filter        |
| C105   | Ceramic Filter      | CFT-455B                         | 1    | 3010012                     | AM IF Filter        |
| C106, C132, C133, C136, C220, C246   | Capacitor-Elect.    | CE04W25V4.7μF                    | 1    | 352750471                   |                     |
| C110, C121, C119, C257, C128<br>C129, C241, C140, C174, C256<br>C133, C114, C247, C253, C143<br>C246, C252, C254 | Capacitor-Elect.    | CE04W50V0.47μF                   | 6    | 352784791                   |                     |
| C115, C116   | Capacitor-Elect.    | CE04W50V1μF                      | 10   | 352780101                   |                     |
| C175   | Capacitor-Elect.    | CE04W16V10μF                     | 8    | 352741001                   |                     |
| C179, C263   | Capacitor-Elect.    | CE04W50V2.2μF                    | 2    | 352780221                   |                     |
| C180   | Capacitor-Elect.    | CE04W50V3.3μF                    | 1    | 352780331                   |                     |
| C181, C182, C258, C183, C186   | Capacitor-Elect.    | CE04W25V10μF                     | 2    | 352751001                   |                     |
| C184   | Capacitor-Elect.    | CE04W16V10μF                     | 1    | 352741001                   |                     |
| C185   | Capacitor-Elect.    | CE04W16V100μF                    | 5    | 352741011                   |                     |
| C218   | Capacitor-Elect.    | CE04W16V220μF                    | 1    | 352742211                   |                     |
| C221   | Capacitor-Elect.    | CE04W16V1000μF                   | 1    | 352741021                   |                     |
| C259   | Capacitor-Elect.    | CE04W16V47μF                     | 1    | 352744701                   |                     |
| C117   | Capacitor-Elect.    | CE04W25V47μF                     | 1    | 352754701                   |                     |
| C118   | Capacitor-MS        | CE04W16V470μF                    | 1    | 352744711                   |                     |
| C137   | Capacitor-MS        | MS04C50V0.33μF                   | 1    | 392083397                   |                     |
| C119, C216   | Capacitor-MS        | MS04C50V0.22μF                   | 1    | 392082297                   |                     |
| C178   | Capacitor-MS or LR  | MS04C25V10μF                     | 1    | 392051007                   |                     |
| C250   | Capacitor-DE        | MS04C50V0.47μF or LR04B50V0.47μF | 2    | 392084797 or 392684791      |                     |
| R118   | Capacitor-DE        | DE93M50V47000μF                  | 1    | 374124737                   |                     |
| R127   | Resistor-Semi Fixed | DE93M50V220000μF                 | 1    | 374122247                   |                     |
| R154   | Resistor-Semi Fixed | R-HK100KB3P                      | 1    | 5225013                     | STRENGTH METER      |
| R157   | Resistor-Semi Fixed | R-H4.7KB3M                       | 1    | 5225019                     | 19KHz               |
| PL101  | Resistor-Semi Fixed | R-HK10KB3P                       | 1    | 5225017                     | MUTING LEVEL        |
|  | Relay               | N10HR1KBD                        | 1    | 5225024                     | SEPARATION          |
|  |                     | L-13                             | 1    | 25065026                    | AFC                 |

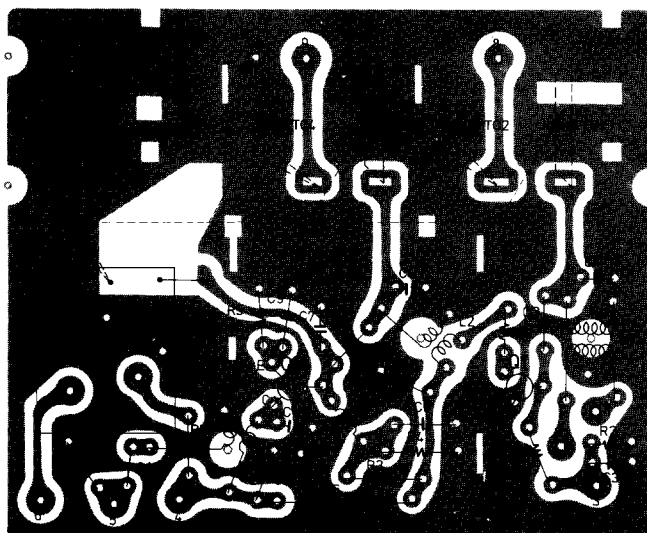
## LA-3350 BLOCK DIAGRAM



**FRONT END BOARD VIEW**  
**FAT-48EJ-41 (TX-2500)**  
**TOP VIEW**



## BOTTOM VIEW

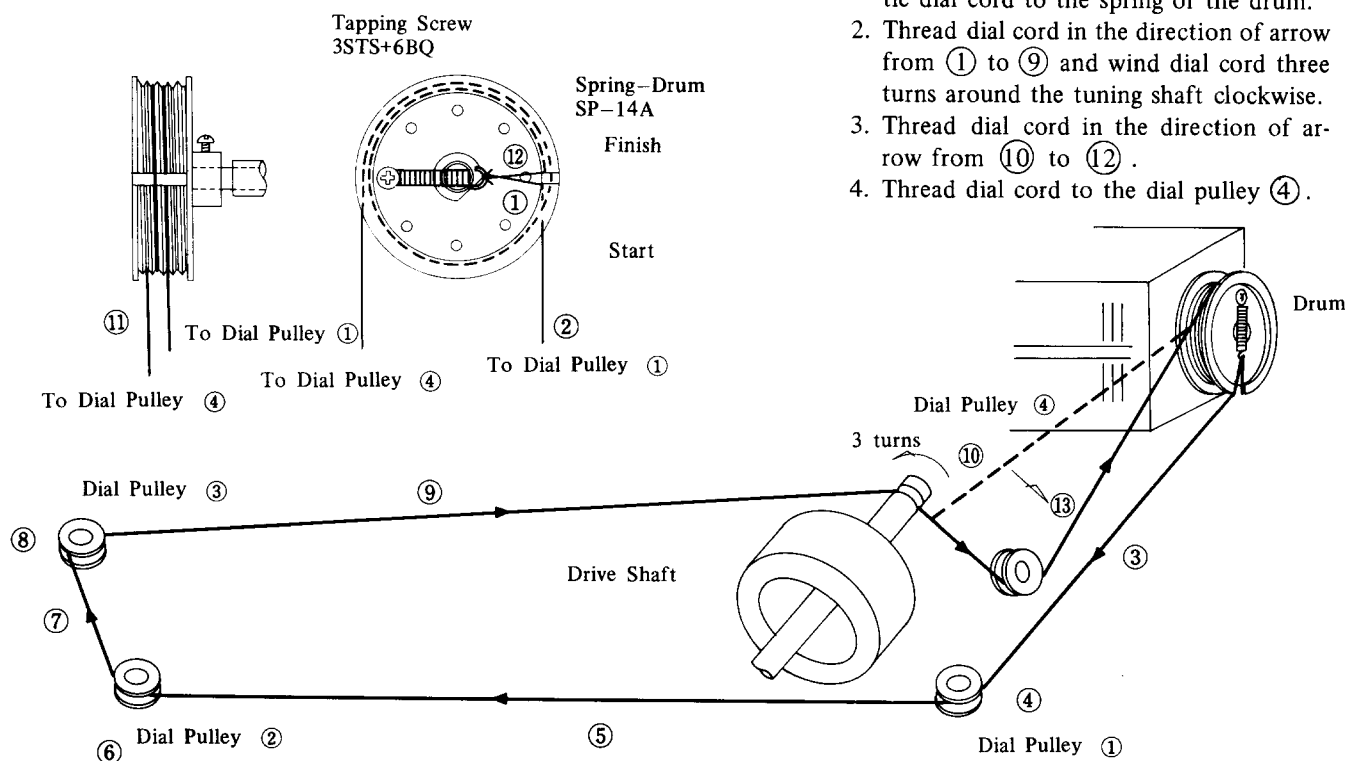


| PARTS NO. | DESCRIPTION      | SPECIFICATIONS | STOCK NO. | REMARKS |
|-----------|------------------|----------------|-----------|---------|
| Q1        | Transistor (FET) | 2SK55(D)       | 2210954   | RF Amp. |
| Q2        | Transistor       | 2SC535(B)      | 2210882   | Mixer   |
|           | OSC Block        | FO--20EA       |           |         |

## Terminals

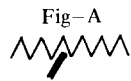
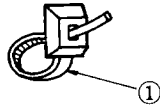
- |                     |            |
|---------------------|------------|
| 1. ANT (300-ohm)    | 6. AFC     |
| 2. ANT (300-ohm)    | 7. FM. E   |
| 3. AGC              | 8. AM. RF  |
| 4. +B               | 9. AM. OSC |
| 5. IF OUT (600-ohm) | 10. AM. E  |

## DIAL CORD ARRANGEMENT

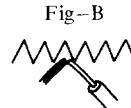


## SERVICE PROCEDURE

### RELEASING BINDER



the state in  
which it stays



a small driver  
or a fine pin

fig- 29

A little space opens up in between the teeth as the part (1) is pressed slightly in the same direction as in tightening, as shown in fig-29, the binder can come off with the driver or pin having the pointed end being pushed up in the direction as shown by the arrow.

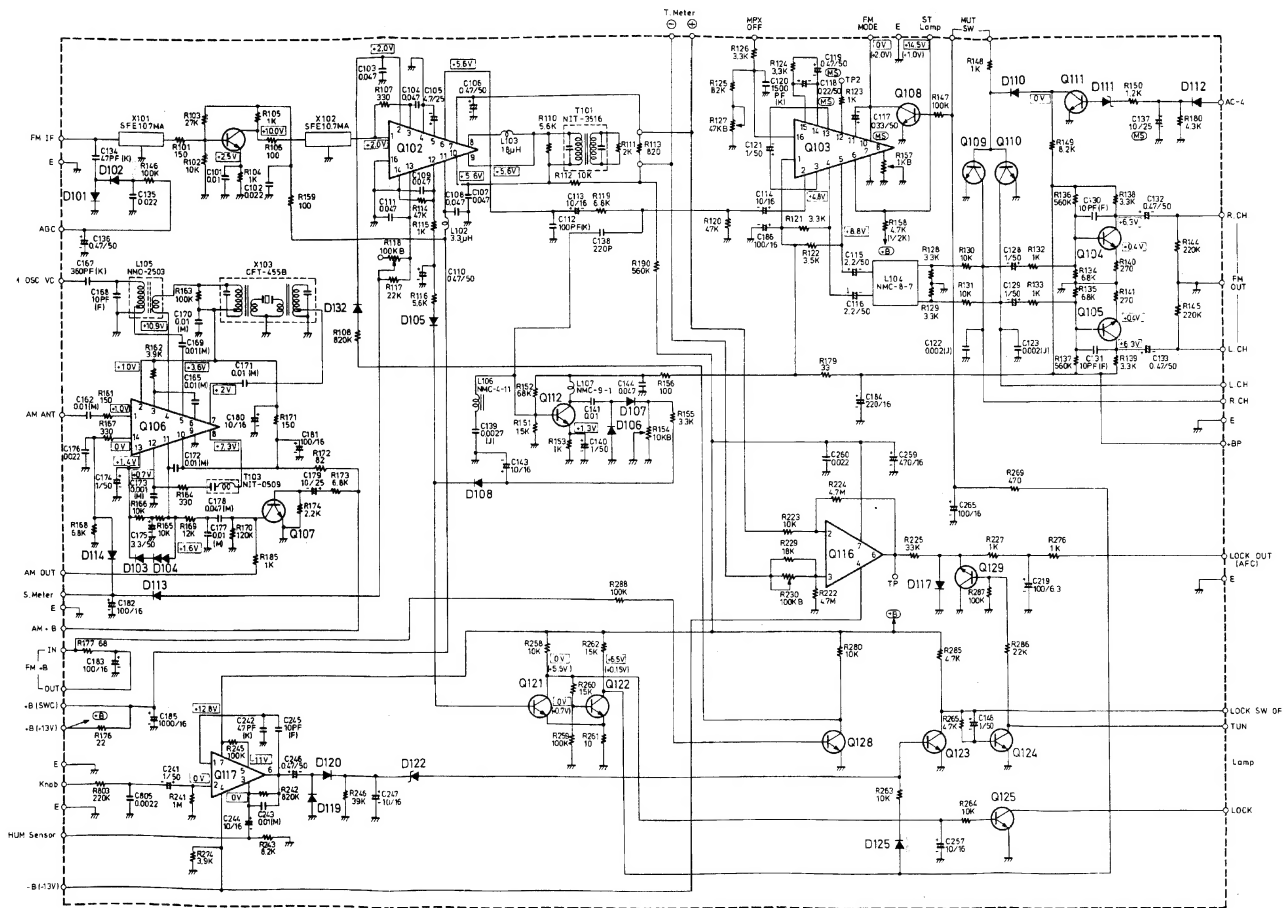
### USEING SENSOR SWITCH

While the sensor SW is ordinarily set to LOW position when the unit is delivered, there may be occasions when the sensitivity of the inductive ham detection device is lessened as one of the coaxial cables is earthed with the aerial in joint use. Only in this or similar case is the sensor SW allowed to be brought to HIGH position.

### REMOVING TUNING KNOB

Being fixed in position on the shaft with the 4 mm enamel screw, the tuning knob should be taken off by the use of a hexagonal driver.

**TX-2500**  
**FM/AM SCHEMATIC DIAGRAM(Change Parts)**  
**NAIMX-345**



**SERVO LOCKED CIRCUIT ALIGNMENT**

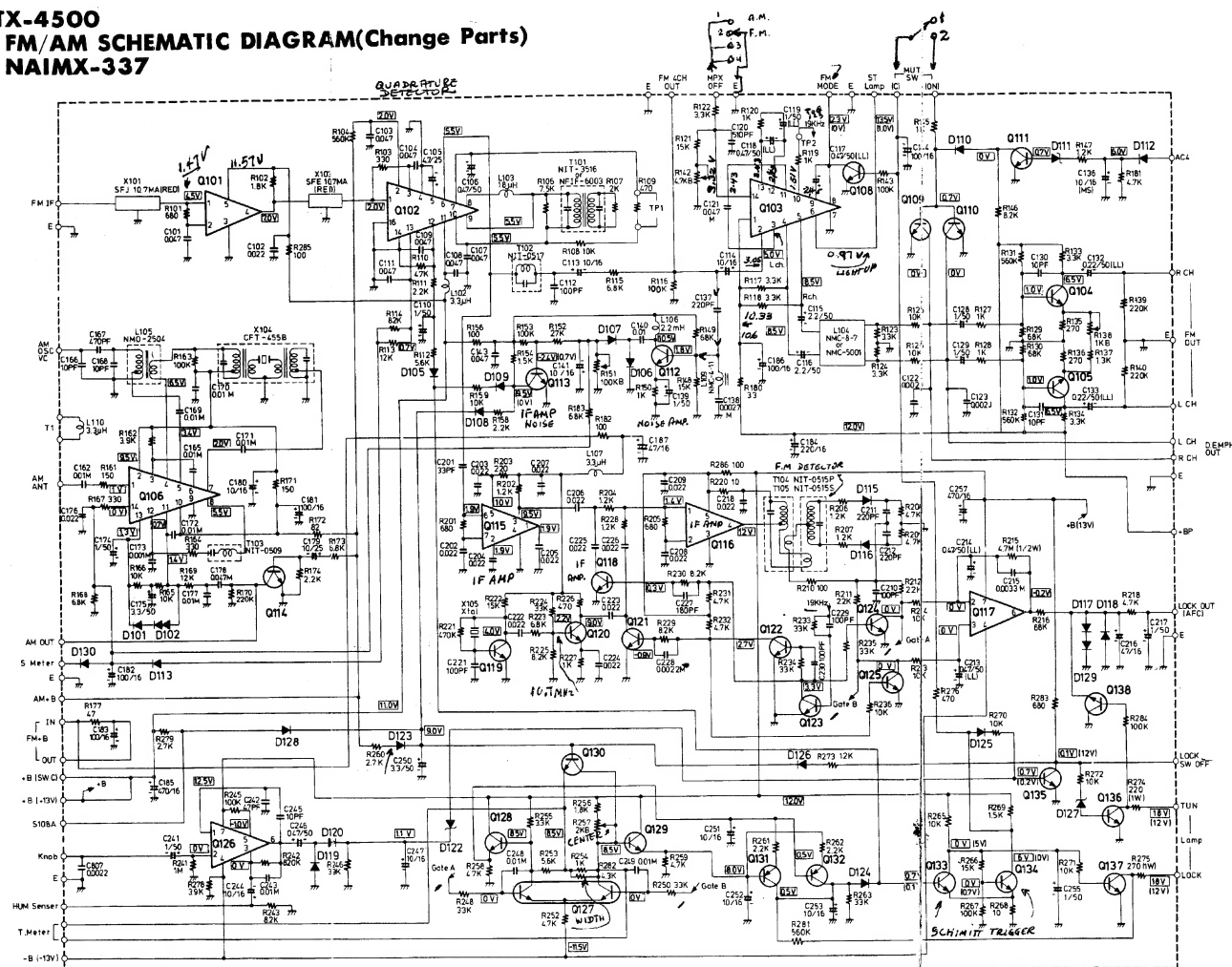
1. Set MUTING switch to off.
2. Set the radio dial to center needle deflection on tuning meter when the FM program source is received.
3. Set MUTING switch to on.
4. Adjust R230 to center needle deflection on tuning meter.

NOTES  
 ALL RESISTORS ARE IN OHMS, 1/4WATT UNLESS OTHERWISE NOTED.  
 ALL CAPACITORS ARE IN  $\mu$ F, 500VWV UNLESS OTHERWISE NOTED.  
 ELECTROLYTIC CAPACITORS (  $\text{---}\text{||}\text{---}$  ) ARE IN  $\mu$ F/WV.  
 VOLTAGE (MEASURED WITH V.T.V.M.)  
 $\text{---}\text{V}$  DC VOLTAGE (NO INPUT SIGNAL).  
 $\text{---}\text{V}$  DC VOLTAGE (FM STEREO).  
 PUT "K" MARK AT THE BACK OF SERIAL NUMBER AFTER A CHANGE.

**FM/AM PC BOARD(NAIMX-345)-PARTS LIST**

| CIRCUIT NO.                             | STOCK NO.        | DESCRIPTION                     |
|---|------------------|---------------------------------|
| <b>TRANSISTORS</b>                      |                  |                                 |
| Q101                                    | 2210123          | 2SC380 (O), FM IF Amp.          |
| Q104, Q105                              | 2210136          | 2SC1312 (F), Audio Amp.         |
| Q107, Q111                              | 2210046-1        | 2SC732 (BL) or Transient Killer |
|   | 2210045          | Same as above                   |
| Q108                                    | 2210244          | 2SC735 (Y) or Muting            |
| Q109, Q110                              | 2210943          | 2SC1317 (R) or Schmitt Trigger  |
| Q112                                    | 2210086          | 2SC733 (BL), Noise Amp.         |
| Q121, Q122                              | 2210244          | 2SC735 (Y) or Schmitt Trigger   |
|   | 2210943          | 2SC1317 (R)                     |
| Q123                                    | Same as above    | Gate Circuit                    |
| Q124                                    | 2210085          | Same as above                   |
| Q125                                    | 2210085          | Tuned Lamp Switch               |
| Q128                                    |                  | Locked Lamp Switch              |
| Q129                                    |                  | 2SC733 (GR), AFC Switch         |
| <b>ICs</b>                              |                  |                                 |
| Q102                                    | 222421           | HA-1137 Quadrature Det.         |
| Q103                                    | 222449           | LA-3350 MPX                     |
| Q106                                    | 222418           | HA-1151 AM                      |
| Q116                                    | 222424           | TA-7504S OP Amp.                |
| Q117                                    | 222423           | TA-7136P Hum Sensor Amp.        |
| <b>DIODES</b>                           |                  |                                 |
| D101, D106, D102                        | 2231031          | 1(N)60(N)FM                     |
| D107, D108, D110, D112-D114, D119, D120 | 223105           | 1S1555                          |
| D103, D105, D117, D125, D132            | 4000022          | VD-1212, Varistor               |
| D104                                    | 223945           | RD5.1EB or                      |
| D111                                    | 224012           | WZ-052                          |
| D122                                    | 223943           | RD4.7EB or                      |
|   | 224011           | YZ-047                          |
| <b>COILS</b>                            |                  |                                 |
| L102                                    | 223105           | NCH1005                         |
| L103                                    | 223024           | NCCH-1501                       |
| L104                                    | 223074           | NCCH-1506                       |
|   | 223032           | NMC-8-7                         |
| L105                                    | 223104           | NMC-5001                        |
| L106                                    | 2232013          | NMO-2503                        |
| L107                                    | 2233018          | NMC-4-11                        |
|   | 2233031          | NMC-9-1                         |
| <b>TRANSFORMERS</b>                     |                  |                                 |
| T101                                    | 223101           | NFIF-6003                       |
| T103                                    | 223083           | NIT-3516                        |
|   | 2232041          | NIT-0509                        |
| <b>CERAMIC FILTERS</b>                  |                  |                                 |
| X101, X102                              | 3010007, 3010006 | SFE10.7MA (Blue)                |
|   | 3010008          | SFE10.7MA (Red)                 |
| X103                                    | 3010012          | SFE10.7MA (Orange)              |
|   |                  | CFZ-455B                        |
| <b>VARIABLE RESISTOR</b>                |                  |                                 |
| R118                                    | 5225013          | R-HK100KB3P                     |
| R127                                    | 5225019          | R-H4.7KB3M                      |
| R154                                    | 5225017          | R-HK10KB3P                      |
| R157                                    | 5225024          | N10HRIKBD                       |
| R230                                    | 5225013          | R-HK100KB3P                     |

**TX-4500**  
**FM/AM SCHEMATIC DIAGRAM(Change Parts)**  
**NAIMX-337**



|                        |                         |
|------------------------|-------------------------|
| Q101, Q116             | TA7060P                 |
| Q102                   | HA1137                  |
| Q103                   | HA1156W                 |
| Q104, Q105             | 2SC1312(F)              |
| Q106                   | HA1151                  |
| Q108, Q111, Q114       | 2SC945 (Q)              |
| Q109, Q110, Q118, Q130 | 2SC1317(R) or 2SC735(Y) |
| Q121-Q125, Q133-Q138   | 2SC733(BL)              |
| Q112, Q113, Q128, Q129 | 2SC733(BL)              |
| Q115                   | TA7061AP                |
| Q117                   | TA7064S                 |
| Q119, Q120             | 2SC380(D)               |
| Q126                   | TA7136P                 |
| Q127                   | 2SC1583G                |
| Q131, Q132             | 2SA726(F)               |

|                        |                   |
|------------------------|-------------------|
| D101, D105, D110, D118 | 1S1555            |
| D124, D125, D128       |                   |
| D102                   | VD1212            |
| D106-D109              |                   |
| D112-D117, D119, D120  | 1N60              |
| D123, D126, D129       |                   |
| D111                   | WZ051 or RD51EB   |
| D122                   | YZ-047 or RD4.7EB |
| D127                   | WZ061 or RD5.6EC  |

NOTES  
 ALL RESISTORS ARE IN OHMS,  $\mu$ WATT UNLESS OTHERWISE NOTED.  
 ALL CAPACITORS ARE IN  $\mu$ F, 500VW UNLESS OTHERWISE NOTED.  
 ELECTROLYTIC CAPACITORS (E-10) ARE IN  $\mu$ F/WV.  
 VOLTAGE (MEASURED WITH V.T.M.)  
 (V) DC VOLTAGE (N) INPUT SIGNAL  
 (I) V) DC VOLTAGE (F) STEREO  
 PUT "K" MARK AT THE BACK OF SERIAL NUMBER AFTER A CHANGE

**FM/AM PC BOARD (NAIMX-337)-PARTS LIST**

| CIRCUIT NO.   | PART NO.             | DESCRIPTION    |
|---|----------------------|----------------|
| <b>ICs</b>  |                      |                |
| Q101, 116   | 222407               | TA-7060P       |
| Q102  | 222421               | HA-1137W       |
| Q103  | 222413               | HA-1156        |
| Q106  | 222418               | HA-1151        |
| Q115  | 222402               | TA-7061AP      |
| Q117  | 222424               | TA-7504S       |
| Q126  | 222423               | TA-7136P       |
| <b>Transistors</b>  |                      |                |
| Q104, 105   | 2210136              | 2SC1312(F)     |
| Q108, 111, 114  | 2210046-1 or 2210045 | 2SC732(BL)     |
| Q109, 110, 118, 130, 121-125, 133-138                     | 2210943 or 2210244   | 2SC732(GR)     |
| Q112, 113, 128, 129                                       | 2210086              | 2SC1317(R)     |
| Q119, 120   | 2210123              | 2SC735(Y)      |
| Q127  | 2210707              | 2SC733(BL)     |
| Q131, 132   | 2210416              | 2SC380(O)      |
|   |                      | 2SC1583(G)     |
|   |                      | 2SA726(F)      |
| <b>Diodes</b>   |                      |                |
| D101, 105, 110, 118, 124, 125, 128                        | 223105               | 1S1555         |
| D106-109, 112, 113, 115-117, 119, 120, 122, 126, 129, 130 | 2231031              | 1N60 FM        |
| D111  | 223945 or 224012     | RD5.1EB        |
| D122  | 223943 or 224011     | WZ-052         |
| D127  | 223948 or 223928     | RD4.7EB        |
|   |                      | YZ-047         |
|   |                      | RD5.6EC        |
|   |                      | WZ-061         |
| <b>Varistor</b>   |                      |                |
| D102  | 4000022              | VD1212         |
| <b>Coils</b>  |                      |                |
| L102, 110   | 233105 or 233024     | NCH1005        |
| L103  | 233074               | NCCH1501       |
| L104  | 233104 or 233032     | NCCH1506       |
| L105  | 232042               | NMC-5001       |
| L106  | 233031               | NMC-8-7        |
| L107  | 233024               | NMC2504        |
| L109  | 233018               | NMC-9-1        |
|   |                      | NCCH1501       |
|   |                      | NMC-4-11       |
| <b>Transformers</b>                                       |                      |                |
| T101  | 233083 or 233101     | NIT-3516       |
| T102  | 233084               | NFIP-6003      |
| T103  | 232041               | NIT-0517       |
| T104  | 233078               | NIT-0509       |
| T105  | 233079               | NIT-0515P      |
|   |                      | NIT-0515S      |
| <b>Ceramic Filters</b>                                    |                      |                |
| X101  | 3010018              | SFJ10.7MA(RED) |
| X103  | 3010006              | SFE10.7MA(RED) |
| X104  | 3010012              | CFT-455B       |
| <b>Crystal Oscillator</b>                                 |                      |                |
| X105  | 3010015              | XTL-10.7M      |
| <b>Variable Resistors</b>                                 |                      |                |
| R138  | 5225018              | R-HK1KB3P      |
| R142  | 5225019              | N10HR4.7KBD    |
| R151  | 5225016              | R-HK100KB3M    |
| R257  | 5225055              | N10HR2KBC      |